Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2017

Physics

Assessment Unit AS 1

assessing

Module 1: Forces, Energy and Electricity

[AY111]

TUESDAY 23 MAY, MORNING

MARK SCHEME

Subject-specific Instructions

In numerical problems, the marks for the intermediate steps shown in the mark scheme are for the benefit of candidates who do not obtain the final correct answer. A correct answer and unit, if obtained from a valid starting-point, gets full credit, even if all the intermediate steps are not shown. It is not necessary to quote correct units for intermediate numerical quantities.

Note that this "correct answer" rule does not apply for formal proofs and derivations, which must be valid in all stages to obtain full credit.

Do not reward wrong physics. No credit is given for consistent substitution of numerical data, or subsequent arithmetic, **in a physically incorrect equation**. However, answers to subsequent stages of questions that are consistent with an earlier incorrect numerical answer, and are based on physically correct equation, must gain full credit. Designate this by writing **ECF** (Error Carried Forward) by your text marks.

The normal penalty for an arithmetical and/or unit error is to lose the mark(s) for the answer/unit line. Substitution errors lose both the substitution and answer marks, but 10^n errors (e.g. writing 550 nm as 550×10^{-6} m) count only as arithmetical slips and lose the answer mark.

AVAILABLE MARKS

1 **(a)**

Quantity	SI base unit(s)
Work Done	$kg\,m^2s^{-2}$
Density	$kg\,m^{-3}$
Resistance	$kg\,m^2s^{-3}A^{-2}$
Velocity/speed	$m\,s^{-1}$

$4 \times [\frac{1}{2}]$ round down [2]

(b) **(i)** Similarity both have numerical value/measured in metre/both have a unit/have magnitude. Not 'how far object goes' [1]

(ii) Difference distance scalar, displacement vector/displacement has direction, distance doesn't [1]

(c) **(i)** Acceleration [1]

(ii) 1. Power
2. Energy [1]

(iii) force, weight [1]
N (not base units) [1] [2]

8

2 **(a)** **(i)** Y axis 2h/t or h/t
X axis t t
(axes reversed ok) [1]

SE: h against t^2 (or $\frac{t^2}{2}$)

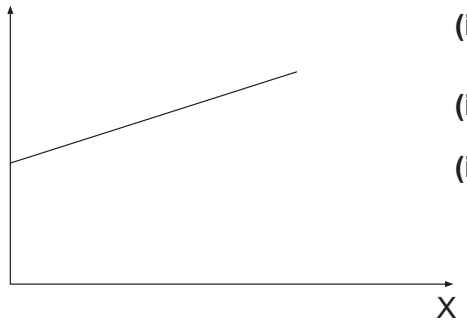
(a) **(i)** [0]

(ii) max [1] if straight line through origin

(iii) 2 × gradient (gradient) [1]

(iv) [0]

(ii) Y



Straight line [1]
Intercept on Y axis [1] [2]
(x axis if axes reversed)

(iii) grad of graph if $\frac{2h}{t}$, 2 × gradient if $\frac{h}{t}$ [1]

(iv) intercept on Y axis/2 if $\frac{2h}{t}$, intercept if $\frac{h}{t}$ [1]

(b) Distance between release point and light gate 1 must be constant [1]
To ensure u is constant [1] [2]

7

3 **(a)** **(i)** $v^2 = u^2 + 2as$ eqn or subs [1]
$0 = u^2 - 2 \times 9.81 \times 1.2$
$u = 4.85\,m\,s^{-1}$ [1] [2]

(ii) $v = u + at$ or $s = \frac{t}{2}(u + v)$ eqn or subs [1]
$0 = 4.85 - 9.81 \times t$
$t = 0.49$ [1]
hang time = $2t = 0.98\,s$ [1] [3]

(b) Increase (take-off) velocity/angle [1]

6

					AVAILABLE MARKS
4	(a)	Resultant force = 65 × 1.4 = 91 N	[1]		
		65 × 1.4 = T – (65 × 9.81) or RF = T – mg	[1]		
		T = 730 N SE: 547 N scores 2/3	[1]	[3]	
	(b)	weight/force of gravity	[1]		
		drag/air resistance/upthrust/reaction force	[1]		
		initially: W > D	[1]		
		constant velocity: W = D or no resultant force	[1]		
		final: W < D	[1]	[5]	

Quality of written communication

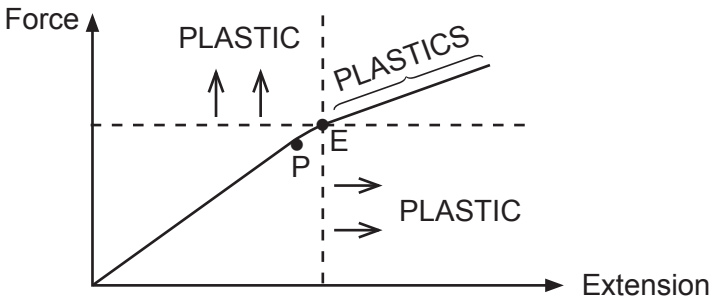
2 marks
The candidate expresses ideas clearly and fluently, through well-linked sentences and paragraphs. Arguments are generally relevant and well structured. There are few errors of grammar, punctuation and spelling.

1 mark
The candidate expresses ideas clearly, if not always fluently. Arguments may sometimes stray from the point. There are some errors in grammar, punctuation and spelling, but not such as to suggest a weakness in these areas.

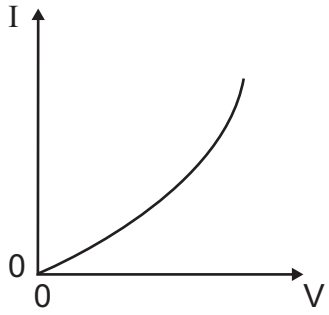
0 marks
The candidate expresses ideas satisfactorily, but without precision. Arguments may be of doubtful relevance or obscurely presented. Errors in grammar, punctuation and spelling are sufficiently intrusive to disrupt the understanding of the passage. [2] 10

5	(a)	(i) force × distance moved	[1]		
		in direction of force	[1]	[2]	
		(ii) useful energy out/energy in (× 100)		[1]	
	(b)	K.e. = $0.5 \times 0.6 \times 5^2 = 7.5$	[1]		
		85% of energy = 6.375 ECF*	[1]		
		$F \times 5 \times 10^{-3} = 6.375$			
		F = 1275 N	[1]	[3]	6
		incorrect efficiencies leading to: 1764 N			
		1500 N			
		225 N score 2/3			

					AVAILABLE MARKS
6	**(a)**	Force is directly proportional to extension produced provided proportional limit not exceeded.	[1] [1]	[2]	



	(b)	**(i)** correctly labelled point – P		[1]	
		(ii) correctly labelled point – E		[1]	
	(c)	**(i)** Material does not return to its original dimensions when force is removed/permanently deformed when the force is removed.		[1]	
		(ii) Correct region identified		[1]	
	(d)	**(i)** F = kx F = 7.5 × 0.085 = 0.638 N	subs [1] ans [1]	[2]	
		(ii) a = F/m = 0.638/25 × 10^{-3} ecf from **d(i)** = 25.5 m s^{-2}		[1]	9
7	**(a)**	Q = (ne) = It = 1.8C or (15 × 10^{-3} × 2 × 60)	eqn or subs [1]		
		n = It/e = 15 × 10^{-3} × 2 × 60/1.6 × 10^{-19} n = 1.13 x 10^{19} (ecf from Q)	[1]	[2]	
		t in mins → 1.9 × 10^{17} scores 1/2			
	(b)	**(i)** $R = \frac{V^2}{P}$ or $P = IV$ and $V = IR$	[1]		
		$R = 4\,\Omega$	[1]	[2]	
		(ii) Temp less [1], R decreases [1]		[2]	6

					AVAILABLE MARKS
8	(a)	Current (through a material) is (directly) proportional to voltage across it	[1]		
		provided temp (and other physical properties) remain same	[1]	[2]	
	(b) (i)	straight line through origin		[1]	
	(ii)	correct graph 		[1]	
	(c) (i)	$R_p = 2R/3$ or $R_T = \frac{5R}{3}$	[1]		
		$R_T = \frac{10}{1.2} = 8.3\,\Omega$	[1]		
		$R = 5\,\Omega$	[1]	[3]	
	(ii)	$V_S = 1.2\,(5) = 6\,V$ $V_A = 10 - 6 = 4\,V$		[1]	8
9	(a) (i)	• V & I recorded	[1]		
		• wire length measured	[1]		
		• diameter of wire	[1]		
		• 5 lengths of wire used	[1]	[4]	
	(ii)	R vrs L (or R v $\frac{L}{A}$)	[1]		
		Gradient = ρ/A (or ρ) ρ = grad × A Accept correct alternatives	[1]	[2]	
	(b) (i)	Gradient of line will be halved or consistent with candidate's graph (R v $\frac{L}{A}$ graph – no change)		[1]	
	(ii)	Resistivity will not change		[1]	8

						AVAILABLE MARKS
10	**(a)**	**(i)**	Equal resistances, V is half or $V_{out} = \frac{10 \times 12}{20}$	[1]		
			voltage = 6 V	[1]	[2]	
		(ii)	R_p = 6 kΩ	[1]		
			R_T = 16 kΩ or $V_{out} = \frac{12(6)}{10 + 6}$ (ecf R_P)	[1]		
			V = 4.5 V	[1]	[3]	
	(b)	**(i)**	voltmeter reading = 0		[1]	
		(ii)	Switch shorts out 10 kΩ resistor **or** Resistance between AB is zero/short circuit		[1]	7
					Total	**75**