

Movement and position

Mark Scheme 1

Level	IGCSE(9-1)
Subject	Physics
Exam Board	Edexcel IGCSE
Module	Double Award (Paper 1P)
Topic	Forces and motion
Sub-Topic	Movement and position
Booklet	Mark Scheme 1

Time Allowed: 62 minutes

Score: /51

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	775%	70%	60%	55%	50%	<50%

Question number	Answer	Notes	Marks
1 (a)	B – the horizontal part of the line;		1
(b)	A – the area under the line;		1
(c)	B – the distance moved divided by the time taken;		1

Total 3 marks

Question number	Answer	Notes	Marks
2	Any 5 of 1. determine / measure distance; 2. determine / measure time; 3. Appropriate measuring instrument for distance OR time; 4. Use a suitable distance /count laps (of known length); 5. repeat experiment/ calculate average; 6. Speed = distance / time OR finding the gradient ; 7. Suitable experimental precaution, e.g. reaction time considered, consistent height on track, time from a predetermined consistent point;	Allow idea of published track length use of split times e.g. 1 lap or circuit Ignore 'human error'	5
		Total	5

Question number	Answer	Notes	Marks
3 (a) (i)	42 (m/s)	Allow range 42 - 43	1
(ii)	Attempt to calculate slope; Answer; Unit; $42 \div 15$ 2.8 m/s^2	Allow value from (i) e.g. $43 \text{ m/s} \rightarrow 2.9 \text{ m/s}^2$ $42.5 \rightarrow 2.83 \text{ m/s}^2$ $45 \rightarrow 3 \text{ m/s}^2$ not $42/120$ allow $42/20$	3
(iii)	Attempt to calculate an area under graph line; Appropriate further working (e.g. adding areas); Answer; $(\frac{1}{2} \times 15 \times 42) + (80 \times 42) + (\frac{1}{2} \times 25 \times 42)$ $315 + 3360 + 525$ 4200 (m)	Allow value from (i) e.g. $43 \text{ m/s} \rightarrow 4300 \text{ m}$ first 2 MP may be gained using the trapezium method, i.e. $42 \times (120+80)/2$ Bald correct answer scores 3	3

Question number	Answer	Notes	Marks
(b)	Any three from 1. Stopping distance affected by speed or mass; 2. For faster plane, stopping distance greater/ runway too short ; 3. for heavier plane stopping distance greater/ runway too short; 4. Attempt to calculate stopping distance from graph; 5. Data shows most/all of runway already used;	ignore time = 500/40 Allow a momentum argument for MP1, 2, 3	3
		Total	10

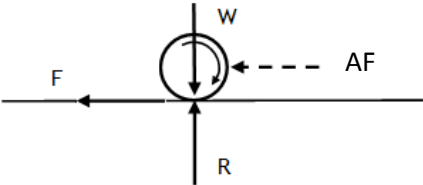
Question number	Answer	Notes	Marks
4 (a) B D	constant velocity of <u>5 m/s</u> Idea that velocity/speed = 0	Allow speed is <u>5 m/s</u> Allow "stops", "stationary", "at rest"	2
(b)	Idea of greater slope (for stage E); e.g. the gradient is steeper	Allow reverse argument, provided stage A is identified e.g. "stage A has a shallower slope" Allow attempts to demonstrate through - calculation of both gradients - qualitative comparison of data	1
(c)	distance = speed × time OR distance = area under graph; attempt to find any area; attempt to total correct areas (or use trapezium method); evaluation; e. distance = area under graph 7×7 or $\frac{1}{2} \times 7 \times 3$ $(7 \times 7) + (\frac{1}{2} \times 7 \times 3) = 49 + 10.5$ 59.5 (m)	The correct relationship can be implicit in the working 59.5 (m) with no working = full marks Allow the trapezium method - e.g. $7 \times ((7+10) \div 2) = 7 \times 8.5$ = 59.5 (m)	4
(d)	Correct equation shown ; e.g. (average speed) = distance (moved) / time (taken) Substitution of correct distance and suitable time; Correct evaluation ; e.g. $106.5/27$ 3.94 (m/s)	Allow d/t Allow (ecf) max 2 4.26 (m/s) (use of time = 25 s) 3.55 (m/s) (use of time = 30 s) Allow reverse argument max 2 e.g. $106.5 \div 4 = 26.6$ (s)	3

Question number	Answer	Notes	Marks
5	<p>Any FOUR of</p> <p>Reaction time of driver (inc comment on drink/drugs / driver paying attention / driver distracted /driver tired);</p> <p>Condition of car’s brakes/force applied to brakes; Condition of car’s tyres; Condition of road surface (inc ice/water/mud /friction ideas);</p> <p>Stopping distance of car;</p> <p>Velocity / speed / behaviour of rabbit (across road);</p> <p>Distance of rabbit from car;</p> <p>Visibility factor (e.g. fog / dirty windscreen);</p> <p>ALLOW MAXIMUM of TWO from these</p> <p>Kinetic energy of car; Momentum of car; Velocity / speed of car; Mass / weight of car / number of passengers;</p>	<p>ACCEPT ‘thinking distance / time’ as an alternative to these points IGNORE ‘condition of driver’</p> <p>ACCEPT ‘braking distance (of the car)’ as an alternative to these three ‘condition’ points IGNORE ‘condition of car’</p> <p>i.e. momentum of car <u>and</u> velocity of car <u>and</u> mass of car only scores two of the marks available</p>	4

Total 4 Marks

Question number	Answer	Notes	Marks
6 (a) (i)	6.1 (m);		1
(ii)	any two from: - MP1. (on distance-time graph,) flat line means zero speed / eq MP2. (so) count when slope is zero; MP3. 7 (times);	allow flat or horizontal for zero slope	2
(b) (i)	(average) speed = $\frac{\text{(total) distance moved}}{\text{(total) time taken}}$	allow defined symbols ignore 'triangles'	1
(ii)	Substitution; Calculation; Matching unit; e.g. Average speed = $\frac{6.1}{(7 \times 60)}$ = 0.0145 = 0.015 m/s	allow both substitution and calculation marks for a correct value without working allow 6.1, or ecf for distance 7 for time allow alternatives with compatible unit, e.g. 1.45 cm/s OR 1.5 cm/s 14.5 mm/s OR 15 mm/s 0.87 m/minutes 87 cm/minute 870 mm/minute Allow for 1 mark 6 / 7 or 0.9	3

Total 7 marks

Question number	Answer	Notes	Marks
7 (a) (i)	<p>Any two of -</p> <p>MP1. arrow downwards, labelled weight;</p> <p>MP2. arrow upwards, labelled reaction/contact force;</p> <p>MP3. arrow to the left, labelled air friction / air resistance / drag;</p> <p>MP4. arrow along the surface, labelled friction;</p> <p>e.g.</p> 	<p>In MP1, 2 & 3, position of arrows unimportant, but direction must match label</p> <p>Allow initial letters as shown in example</p> <p>ignore</p> <ul style="list-style-type: none"> • gravity <p>allow</p> <ul style="list-style-type: none"> • mg • force of gravity <ul style="list-style-type: none"> • arrow drawn on left or right <p>Accept arrow in either direction for MP4</p> <p>N = normal contact force</p>	2
(ii)	<p>Any three of -</p> <p>MP1. friction/resistance /drag (acts);</p> <p>MP2. (there is an) unbalanced force;</p> <p>MP3. (hence) ball decelerates;</p> <p>MP4. reference to $f_{(R)} = ma$;</p> <p>MP5. (kinetic) energy dissipates / fate of energy discussed;</p>	<p>ignore stem</p> <p>allow</p> <ul style="list-style-type: none"> • resistive forces > {forward/driving} force • there is a resultant force • its momentum changes • accelerates 	3

(b) (i)	idea that friction is (much) less in the air;	allow <ul style="list-style-type: none">• RA• no contact / ground friction• less energy lost	1
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Question number	Answer	Notes	Marks
7 (c) (i)	KE = $\frac{1}{2} mv^2$;	Words or symbols	1
(ii)	<p>Conversion to kg; Substitution into correct equation; Rearrangement; Evaluation;</p> <p>e.g. 45 g = 0.045 kg (or 1 kg = 1000 g etc) $36 = \frac{1}{2} \times 0.045 \times v^2$ $v^2 = \frac{2 \times 36}{0.045}$ (= 1600) 40 (m/s)</p>	<p>allow</p> <ul style="list-style-type: none"> • 1000 seen • steps in any order • correct answer with no working for full marks • up to 3 marks for use of 45 kg \rightarrow 1.26 (m/s) - working must be seen 	4
(iii)	<p>Any one of-</p> <ul style="list-style-type: none"> • (Hit the ball transferring) more energy; • (Hit the ball with) more velocity; • (Hit the ball with) more speed; • (Hit the ball with) more force; 	<p>Ignore</p> <ul style="list-style-type: none"> • harder • power <p>Allow</p> <ul style="list-style-type: none"> • momentum • keep contact for a larger part of the swing • go to a place where g is less (e.g. on the moon) • hit ball at a steeper angle / vertically (e.g. use a more lofted club) 	1

Total 12 marks