OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary GCE

PHYSICS A G481

Unit G481: Mechanics

Specimen Mark Scheme

The maximum mark for this paper is **60**.

This document consists of **6** printed pages and **2** blank pages.

Question Number	Answer	Max Mark
1(a)(i)	Speed is the rate of change of distance / speed = distance/time	[B1]
	Determine the circumference of the circle / Use $2\pi r$ to find distance	[B1]
	Measure the time for one revolution (using a stopwatch) (speed = circumference/time)	[B1]
(ii)	Velocity is the rate of change of displacement / velocity = change in displacement/time	
	The term *displacement* to be <u>included</u> and spelled correctly to score the mark.	[B1]
(iii)	Scalar has magnitude only, e.g: speed	[B1]
	Velocity has <u>both</u> magnitude and direction, e.g: velocity	[B1]
(b)(i)	The gradient is equal to velocity	[B1]
	The girl travels in two opposite directions (wtte)	[B1]
(ii)	**Z** at any peak or trough / **A** / **B** / 3.0 (s) / 6.0 (s)	[B1]
(iii)	Draw tangent at maximum gradient of graph	
	Draw two tangents and find gradients, uncertainty = ± difference in gradients/2; result, e.g. ±0.1ms^{-1}	[4]
2(a)	Acceleration is the rate of change of velocity / $a = (v-u)/t$ with symbols explained	[B1]
(b)(i)	$a = 65/25$	
	$a = 2.6$ (m s^{-2})	[C1]
	$F = ma$ / $F = 1.5\times10^5 \times 2.6$	[C1]
	$F = 3.9\times10^5$ (N) (Possible ecf)	[A1]
(ii)	$s = (u+v)t/2$ / $s = (0+65)\times25/2$	[C1]
	$s = 813 \approx 810$ (m)	[A1]
(c)	Reduce the mass of the aircraft	[B1]
	Correct explanation, e.g: Smaller mass means greater acceleration (wtte).	[B1]
3(a)(i)	power is the rate of work done / power = energy/time	[B1]
(ii)	When a force of 1 N moves 1 m in the direction of the force, then the work done is equal to 1 joule	[B1]
(b)	The <u>component</u> of the force in the direction of the force is $F\cos\theta$.	
	The term *component* to be included and spelled correctly to gain the mark.	[B1]
(c)(i)	$E_p = mgh$	
	$E_p = 500\times9.81\times3.9$	[C1]
	$E_p = 19130 \approx 19000$ (J)	[A1]
(ii)	work done = (25 - 19 =) 6 (kJ)(5.870 kJ if 19130 J used)	[B1]
(iii)	distance up the slope = 3.9/sin30 (=7.8)	[C1]
(iii) cont'd	(Work = *Fx)* force = $(5870/7.8 =)$ 753 (N) (769 N if 6000 J used)	[A1]

Question Number	Answer	Max Mark
4(a)	The extension of a spring is directly proportional to the applied force	**[M1]**
	as long as the elastic limit is not exceeded)	**[A1]**
(b)(i)	Correct pair of values read from the graph	
	force constant = 12/0.080	**[C1]**
	force constant = 150 (N m^{-1})	**[A1]**
(ii)	extension, $x = \frac{20}{12} \times 80 (= 133.33)$ (mm)	**[C1]**
	(E = ½ Fx)	
	energy = $1/2 \times 20 \times 133.33 \times 10^{-3}$	
	energy = 1.33 (J)	**[A1]**
(iii)	The spring has not exceeded its elastic limit	**[B1]**
(iv)	(elastic potential energy = kinetic energy)	
	$\frac{1}{2}kx^2 = \frac{1}{2}mv^2$	**[M1]**
	m and k are constant, therefore $v \propto x$.	**[M1]**
5(a)(i)	Braking distance is the distance travelling by the car when the brakes are applied and the car stops	**[B1]**
(ii)	Thinking distance is the distance travelled by the car in the time taken by the driver to react	**[B1]**
(b)(i)	($E_k = 1/2mv^2$)	
	$E_k = 1/2 \times 800 \times 20^2$	**[C1]**
	$E_k = 1.6 \times 10^5$ (J)	**[A1]**
(ii)	($v^2 = u^2 + 2as$)	
	$0 = 20^2 + (2 \times a \times 24)$	**[C1]**
	$a = (-)8.3$ (m s^{-2})	**[A1]**
(c)	**Four** from: Prevents the driver from hitting the steering wheel / windscreen Deflates quickly to prevent whiplash Increases the time/distance to stop Decreases the (impact) force on the driver Much wider area of the bag reduces the pressure	**[B1× 4]**
(d)	No, because the percentage of drivers wearing seat belts is the same	
	There must be other factors like safer cars / crumble zones / side-impact bars / etc	**[B1]**
6(a)	The net force acting on the object must be zero	**[B1]**
6(a) cont'd	The net moment (about any point) must also be zero	**[B1]**
(b)	Taking moments about **A**, we have	
	Sum of clockwise moments = sum of anticlockwise moments	**[C1]**
	(0.25 × 200) + (5.0 × 9.81 × 0.4) = 0.8F	**[C1]**

Question Number	Answer	Max Mark
	F = 87 (N)	**[A1]**
(c)	These forces are opposite but not equal in magnitude .	**[B1]**
7(a)	Young modulus = stress/strain (As long as elastic limit is not exceeded)	**[B1]**
(b)	Strain has no units because it is the ratio of two lengths.	**[B1]**
(c)	A brittle material does not have a plastic region / it breaks at its elastic limit.	**[B1]**
(d)	Ultimate tensile strength is breaking stress for a material	**[B1]**
	Materials can be chosen / tested to prevent collapse of the bridge	**[B1]**
	Paper Total	**[60]**