

Eduqas Physics GCSE
Topic 3.1: Forces and their
interactions
Mark Schemes for Questions by
topic

1.

Question			Marking details	Marks
4.	(a)		Initially weight is greater than air resistance [so he accelerates] (1) as he <u>goes faster</u> air resistance increases (1) eventually the forces balance (1) To award all 3 marks the third statement written down must be linked to one of the previous two statements.	3
	(b)	(i)	Change in momentum = 118×373 (1) = 44014 [kg m/s] (1)	2
		(ii)	Resultant force = $\frac{44014}{42}$ (1) = 1048 [N] (1) ecf from (i) OR use of $F = ma = 118 \times 8.9$ (1) = 1050 [N] (1)	2
	(c)	(iii)	$W = 118 \times 10 = 1180$ N (1) Air resistance = $W - \text{resultant force}$ or $1180 - 1048$ (1) = 132 [N] (1) ecf from (ii) & on weight N.B. Answer mark awarded only if correct sign present e.g. $118 - 1048$ (1) = -930 [N]	3
			Air resistance force small (1) because in contact with small number of air particles [per second] / so need to go very quickly for air resistance to balance weight / so need to go very quickly to reach terminal velocity (1) To award both marks both statements must be linked.	2
Question total				[12]

2.

Question			Marking details	Marks
5.	(a)	(i)	Mass is the amount of inertia or material (accept “stuff” (1), whereas weight is the pull <u>of gravity</u> on the car (1). Do not accept that mass is measured in kg, weight is measured in Newtons.	2
		(ii)	weight = $800 \times 10 = 8000$ [N] (1-ans)	1
	(b)	(i)	3000 [N]	1
		(ii)	1200 [N]	1
		(iii)	$a = \frac{1200(\text{ecf})(\text{ii})}{800}$ (1-sub) = 1.5 [m/s ²] (1-ans)	2
	(iv)	The [horizontal] forces become balanced (accept match / equal / level out) (1) because the <u>air resistance (or drag)</u> increases [with speed] (1) To award both marks both statements must be linked.	2	
Question total				[9]

3.

Question		Answer / Explanatory Notes	Marks Available
		Question total	[6]
4.	(a)	Initial K.E. = $0.5 \times 1500 \times 15^2 = 168\,750$ [J] (1) Final K.E. = $0.5 \times 1500 \times 5^2 = 18\,750$ [J] (1) Loss = $150\,000$ [J] (1) (award 1 mark for doing any subtraction but award no marks for use of $(15-5)^2$.)	3
	(b)	$F = \frac{150000(ecf)}{7.5} = 20\,000$ [N] (1) manip, (1) subst, (1) ans For candidates who present a momentum argument: $\frac{x}{t} = \frac{(u+v)}{2}$ to find time = 0.75 [s](1) momentum change = $15\,000$ [kg m/s](1) $F = \frac{15000(ecf)}{0.75(ecf)} = 20\,000$ [N] (1)	3
	(c)	$F = 20\,000$ [N] ecf from (b)	1
		Question total	[7]

4.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
(a) (i)	2	work = 50×44 (1-subst) = $2\,200$ [J] (1-ans)			
(ii)	1	$3\,200 + 2\,200$ (ecf from (a)(i)) = $5\,400$ [J] (1-ans)			
(iii)	1	$3\,200 - 2\,200$ (ecf from (a)(i)) = $1\,000$ [J] (1-ans)			Negative answer

5.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	any two from: <ul style="list-style-type: none"> bungee rope may snap rope may extend too much student may land in the river 		2	AO2/1 4.1.1 WS1
02.2	gravitational potential kinetic elastic potential	correct order only	1 1 1	AO1/1 4.1.1.1
02.3	$\frac{1}{2} \times 40 \times 35^2$ 24 500 (J)	accept 25 000 (J) (2 significant figures) allow 24 500 (J) with no working shown for 2 marks	1 1	AO2/2 4.1.1.2
Total			7	

6.

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	D the spring has more elastic potential energy than the weight has kinetic energy		(1)

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	<p>A description including three from</p> <p>MP1 Elastic potential energy /EPE (in stretched spring) (1)</p> <p>MP2 (EPE is) transferred to KE (initially) (1)</p> <p>MP3 change from KE to GPE or vice versa(1)</p> <p>MP4 (correct idea of) energy changes continuing</p> <p>MP5 {total mechanical energy /kinetic +potential energy} decreases (continuously) (1)</p> <p>MP6 (Eventually all is transferred to) {thermal/heat} (energy) (1)</p>	<p>care should be taken not to award marks for contradictory examples</p> <p>Starting point for description does not matter</p> <p>Ignore sound energy</p> <p>EPE becomes/goes to KE (initially)</p> <p>condone amplitude decreases to zero KE or PE 'lost' to surroundings</p>	(3)

7.

- (a) (i) straight line between A and B B1
(ii) limit of proportionality B1
- (b) (WD =) $\frac{1}{2} F \times d$ OR $F_{\text{ave}} \times d$ OR 6.0×0.030 OR 18 (J) C1
0.18 J A1
- (c) (i) ($x =$) 2.0 (cm) OR $6.0 - 4.0$ OR $F = kx$ OR 4.0 (N/cm) C1
 $12.0 \times 2.0 / 3.0$ OR 4.0×2.0 OR 8.0 (N) C1
0.80 kg OR 800 g A
- (ii) ($e =$) 1.0 (cm) OR ($\Delta e = -$)1.0 (cm) C1
4.0 N OR 4.0 N A1

[Total: 9]