

Q1. (2018)

a)

01.3		each mistake and its correction may be given in any order		AO3 6.5.4.2.2
	1.26667 (m/s ²) (is wrong)	allow (mean value calculated at 0.20 (N)	1	
	give value to 2 significant figures	allow give value to 1 decimal place allow 1.3 (m/s ²)	1	
	6.7 (m/s ²) (is wrong)	allow (mean value calculated at 0.98 (N) allow test 2 for 0.98 (N) or 7.2 is an anomaly	1	
	discard the anomalous result and recalculate the mean	allow repeat the anomalous test result and re-calculate the mean allow 6.4 (m/s ²)	1	

b)

01.4	(resultant) force is directly proportional to acceleration	allow the larger the (resultant) force, the greater the acceleration allow positive correlation between (resultant) force and acceleration allow mass / weight (of the holder) for (resultant) force	1	AO3 6.5.4.2.2
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Q2. (2018)

01.6	inversely proportional	allow as mass increases, acceleration decreases	1	AO3 6.5.4.2.2
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Q3. (2019)

a)

06.1	thrust decreases	allow air resistance or drag increases ignore air resistance decreases as speed decreases	1	1xAO1 1xAO2 2xAO3 6.5.4.2.1	E
	so there is a resultant force in opposite direction	allow so air resistance or drag is greater than thrust	1		
	lift must decrease (because weight stays the same)		1		
	so there is a resultant downwards force	allow so weight is greater than lift the last two marking points cannot be awarded if there is a reference to the weight increasing	1		

b)

06.2		an answer of 300 000 (kg) scores 5 marks		AO2 6.5.4.1.5 6.5.4.2.2	E
	$a = \frac{(10-80)}{28}$	allow $a = \frac{(80-10)}{28}$	1		
	$a = (-)2.5 \text{ (m/s}^2\text{)}$	a valid equation must have been used to calculate a to score subsequent marks	1		
	$(-) 750\,000 = m \times (-)2.5$	allow a correct substitution using their calculated value of a	1		
	$m = \frac{(-)750\,000}{(-)2.5}$	allow a correct rearrangement using their calculated value of a	1		
	$m = 300\,000 \text{ (kg)}$	allow a correct calculation using their calculated value of a	1		

Q4. (2020)

01.3	weight = mass $\times$ gravitational field strength or $W = mg$	do not accept gravity for gravitational field strength	1	AO1 6.5.1.3	
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Q5. (2020)

a)

02.3	resultant force = mass $\times$ acceleration or $F = ma$		1	AO1 6.5.4.2.2 RPA19	
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b)

02.4	$0.63 = m \times 2.1$		1	AO2 6.5.4.2.2 RPA19	
	$m = \frac{0.63}{2.1}$		1		
	$m = 0.30 \text{ (kg)}$	allow 0.3 (kg)	1		

Q6. (2020)

04.2	resistive force acts on the ball so (resultant) force in opposite direction to velocity or so work is done on the ball	allow friction or air resistance	1 1	AO2 6.5.4.2.1	
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Q7. (2021)

a)

02.5	resultant force = mass × acceleration or $F = ma$	allow force = mass × acceleration	1	AO1 6.5.4.2.2
b)				
02.6	$1800 = m \times 25$		1	AO2 6.5.4.2.2
	$m = \frac{1800}{25}$		1	
	$m = 72 \text{ (kg)}$		1	

Q8. (2021)

a)

06.1	at maximum power the forward force of the engines is constant		1	AO3
	as it accelerates the air resistance increases		1	AO1
	resultant force = force from engines – air resistance		1	AO1
	therefore resultant force decreases		1	AO3
	acceleration is directly proportional to resultant force		1	AO1
				6.5.1.4 6.5.4.2.2 6.5.4.1.5

b)

06.2	$\Delta v = (25.5 - 5.5) \times 330$	allow 6600 m/s	1	AO2 6.5.4.1.5 6.5.5.1
	$a = \frac{((25.5 \times 330) - (5.5 \times 330))}{300}$	allow a correct substitution using incorrectly / not converted values of u and v	1	
	$a = 22 \text{ m/s}^2$	allow a correct calculation using incorrectly / not converted values of u and v	1	
		$a = \Delta v / t$ must have been used to score subsequent marks		
	$m = 630\,000 / 22$	allow a correct substitution using an incorrectly calculated value of a	1	
	$m = 28636.36 \text{ (kg)}$	allow a correct calculation using an incorrectly calculated value of a	1	
	$m = 29000 \text{ (kg)}$	this mark can only be awarded for a calculation using the correct equations	1	

Q9. (2022)

02.5	Level 2: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO3 6.5.4.1.2
	Level 1: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	1–2	
	No relevant content	0	
	Indicative content the effect on speed must be consistent with the cause of the change <ul style="list-style-type: none"> competitors accelerate at the start so speed increases the road is not flat so speed increases going downhill and / or speed decreases going uphill the competitor goes round a bend so speed decreases competitors may tire towards the end (so the force they exert decreases) so they slow down competitors may sprint during the race causing speed to increase may get a puncture so speed would decrease or they would stop resistive forces on competitors may increase/decrease so speed would decrease/increase 		

Q10. (2022)

07.3	as the apple falls / accelerates	allow there is air resistance	1	AO1 6.5.4.1
	air resistance increases	acting on the apple as it falls		
	so resultant force decreases		1	
	so acceleration will decrease	MP3 dependent on MP1 or MP2 being awarded	1	
	acceleration will not be constant, so not a good assumption	MP4 dependent on MP1 or MP2 being awarded	1	
	OR			
	the apple only falls for a short time/distance (1)			
	air resistance is negligible (1)			
	so resultant force is constant (1)	MP3 dependent on MP1 or MP2 being awarded		
	therefore acceleration is constant, so good assumption (1)	MP4 dependent on MP1 or MP2 being awarded		

Q11. (2023)

a)

02.1	Level 3: The plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 6.5.4.2.2
	Level 2: The plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	
	Level 1: The plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content method of varying force <ul style="list-style-type: none"> • clamp a pulley onto the edge of the desk • attach a string to the trolley and place the string over the pulley • attach a mass holder to the string or <ul style="list-style-type: none"> • vary the height of the runway • use wooden blocks measurements <ul style="list-style-type: none"> • place a slotted mass on the mass holder • use $W = mg$ to calculate the force • mark the starting and finishing points of the trolley on the runway • measure the distance between the two marks with a metre rule • time how long it takes to travel between the two marks with a stopclock / timer • use $v = \frac{s}{t}$ and $a = \frac{\Delta v}{t}$ or <ul style="list-style-type: none"> • use light gate(s) to determine time and / or speed • computer calculates acceleration <ul style="list-style-type: none"> • repeat for different numbers of slotted masses allow a description of a method using a ticker timer		

b)

02.2	second law	1	AO1 6.5.4.2.2
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c)

02.3	$\frac{3.6}{1.2} = 3$	1	AO3 6.5.4.2.2
	$1.6 \times 3 = 4.8 \text{ (m/s}^2\text{)}$	1	
	OR (use of $F = ma$) $m = \frac{1.2}{1.6} = 0.75 \text{ (1)}$ $a = \frac{3.6}{0.75} = 4.8 \text{ (m/s}^2\text{) (1)}$		

d)

02.4	resultant force = mass $\times$ acceleration	1	AO1 6.5.4.2.2
	or $F = ma$		

e)

02.5	$0.42 = m \times 1.2$		1	AO2 6.5.4.2.2
	$m = \frac{0.42}{1.2}$		1	
	$m = 0.35 \text{ kg}$		1	

Q12. (2023)

04.1	inertia		1	AO1 6.5.4.2.1
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Q13. (2023)

06.3		allow resistive / frictional force for drag throughout		AO3 6.5.4.1.5
	drag is greater than weight	allow upward force is greater than downward force	1	
	(so) there is a resultant force acting in the opposite direction to the velocity (causing deceleration)		1	
	as velocity decreases the drag decreases		1	
	(until) drag is equal to weight (so velocity is constant)	allow until the resultant force is zero	1	
		ignore upthrust		

Q14. (2024)

a)

06.2	weight depends on mass and gravitational field strength	allow weight = mass $\times$ gravitational field strength allow $W = mg$	1	AO1
	mass decreases (as fuel is burned)		1	AO3
	or gravitational field strength decreases			AO3
	therefore the weight decreases	dependent on MP2 if no other marks are awarded allow 1 mark for the weight decreases because the fuel is used	1	6.5.1.3

b)

06.3	gravitational force acts on the rocket (in the opposite direction to the motion of the rocket)	allow air resistance acts on the rocket (in the opposite direction to the motion of the rocket)	1	AO1
	(and) there are no forces in the direction that the rocket is moving		1	AO2
	(so) resultant force is towards the Earth	allow so the rocket decelerates if MP1 or MP2 awarded	1	AO2 6.5.5.1 6.5.4.2.2