

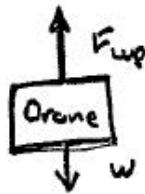
Question			Answer	Max mark	Additional guidance
2.	(a)	(i)	$W = mg$ (1) $W = (5 \cdot 50 + 1 \cdot 25) \times 9 \cdot 8$ (1) $W = 66 \text{ N}$ (1)	3	Accept: 70, 66·2, 66·15 In <u>this</u> question, ignore negative signs in both the substitution and final answer for weight. Do not accept: $F = ma$
	(ii)		$P = \frac{V^2}{R}$ (1) $P = \frac{12^2}{9 \cdot 6}$ (1) $P = 15 \text{ W}$ (1)	3	Accept: 20, 15·0, 15·00 For alternative methods 1 mark for ALL relationships 1 mark for ALL substitutions 1 mark for final answer
		(iii)	Drone <u>accelerates upwards</u> (1) Upward force is greater than weight OR (Upward force remains constant but) weight decreases therefore forces are no longer balanced. OR (Upward force remains constant but) weight decreases therefore there is an unbalanced force (upwards). (1)	2	Look for correct statement of effect first - if incorrect or missing then 0 marks. Accept free-body diagram to aid description of relative size and direction of forces acting on the drone.

Question			Answer	Max mark	Additional guidance
2.	(b)		$W = mg$ $W = 3.4 \times 9.8$ $W = 33.32 \text{ (N)}$ Each cord supports $33.32/2 = 16.66 \text{ (N)}$ $F \cos 35 = 16.66$ $F = 20 \text{ N}$	4	Accept: 20.3, 20.34 Accept: $F \sin 55 = 16.66$ $F = 20 \text{ N}$ Alternative methods: Each cord supports $3.4/2 = 1.7 \text{ (kg)}$ $W = mg$ $W = 1.7 \times 9.8$ $W = 16.66 \text{ (N)}$ $F \cos 35 = 16.66$ $F = 20 \text{ N}$ OR $W = mg$ $W = 3.4 \times 9.8$ $W = 33.32 \text{ (N)}$ $F \cos 35 = 33.32$ Tension in each cord $= 40.6762093/2 = 20 \text{ N}$

Q2(a)(iii) Maximum Mark: 2

RESPONSE 1

Due to the forces no longer being balanced i.e. $F_{\text{upward}} \neq \text{Weight}$ then the drone will fly vertically upwards at a pace. This can be seen in the diagram.



$F_{\text{up}} \neq w$
 $\therefore$ accelerates upwards

RESPONSE 2

It accelerates upwards.

It's ~~weight~~ mass has decreased ^{and} so has its weight.

$$m = 5.5 \text{ kg} \quad w = mg \\ = 5.5 \times 9.8 \\ = 53.9 \text{ N}$$

And since it still has an upwards force of 66.15 N upwards, there is an unbalanced force of $66.15 - 53.9 = 12.25 \text{ N}$ upwards

resulting in an acceleration upwards of $a = \frac{F}{m} = \frac{12.25}{5.5}$
 $= 2.2 \text{ ms}^{-2}$

RESPONSE 3

the drone will accelerate upwards because the weight of the drone is less than when it was carrying the package so the upwards force is greater than the weight.

Q2(b)

Maximum Mark: 4

RESPONSE 1

$$W = 3.4 \times 9.8$$

$$= 33.32 \text{ N}$$

$$\underline{mg \sin \theta} \dots 33.32 \times \sin 35$$

$$= 19.1156 \dots$$

$$T \text{ for both cables} = 19.11 \text{ N}$$

RESPONSE 2

$$W = mg$$

$$= 3.4 \times 9.8$$

$$= 33.32 \text{ N}$$

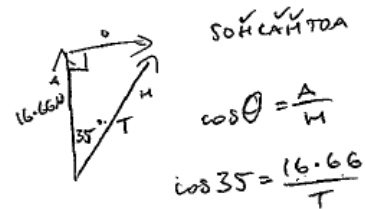
constant height

$\therefore$ Upwards force = 33.32 N

same angle for both drones producing

$\therefore$ Each drone produces upwards force

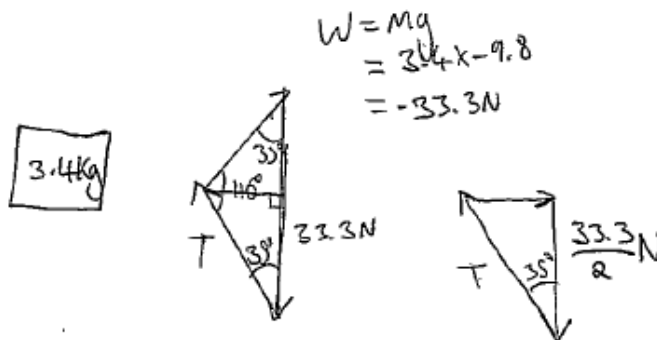
of $\frac{33.32}{2} = 16.66 \text{ N}$ on package



$$T = \frac{16.66}{\cos 35}$$

$$= \underline{\underline{20.3 \text{ N}}}$$

RESPONSE 3



$$\cos 35^\circ = \frac{16.65}{T}$$

$$T = \frac{16.65}{\cos 35^\circ}$$

$$T = 20.3 \text{ N}$$

Question /Response	Mark	Commentary
Q2(a)(iii)	2	
Response 1	2	The candidate makes a correct statement describing the vertical motion of the drone near the end of the response. The justification is just sufficient, with the vectors in the free-body diagram implying that the upward force is greater than the weight.
Response 2	2	The candidate's statement describing the vertical motion of the drone is correct, and has been justified correctly by calculation.
Response 3	2	The candidate has given a correct description and justification.
Q2(b)	4	
Response 1	1	The candidate has correctly calculated the weight of the package, but has not determined the weight supported by each cord. In addition, the candidate has not substituted into an appropriate relationship.
Response 2	4	The candidate has correctly calculated the weight of the package, the weight supported by each cord, substituted correctly into the 'cosine' relationship and given an acceptable final answer.
Response 3	4	Again, the candidate has correctly calculated the weight of the package, the weight supported by each cord, substituted correctly into the 'cosine' relationship and given an acceptable final answer.