Question Number	Answer		Mark
18(a)	(For simple harmonic motion the) acceleration is: • (directly) proportional to displacement from equilibrium position • acceleration is in the opposite direction to displacement **Or** (always) acting towards the equilibrium position **OR** (For simple harmonic motion the resultant) force is: • (directly) proportional to displacement from equilibrium position • force is in the opposite direction to displacement **Or** (always) acting towards the equilibrium position	**(1)** **(1)** **(1)** **(1)**	**(2)**
18(b)(i)	Use of $\omega = 2\pi f$ Use of $v = A\omega \sin \omega t$ with $\sin \omega t = 1$ $A = 1.49 \times 10^{-3}$ (m) <u>Example of calculation</u> $\omega = 2\pi \times 240 \text{ Hz} = 1508 \text{ rad s}^{-1}$ $A = \dfrac{2.25 \text{ m s}^{-1}}{1508 \text{ rad s}^{-1}} = 1.49 \times 10^{-3} \text{ m}$	**(1)** **(1)** **(1)**	**(3)**
18(b)(ii)	Use of $a = -\omega^2 x$ $a = (-)3390 \text{ m s}^{-2}$ (Allow ecf from (b)(i)) <u>Example of calculation</u> $a = -\left(1508 \text{ rad s}^{-1}\right)^2 \times 1.49 \times 10^{-3}\text{m} = 3388 \text{ m s}^{-2}$	**(1)** **(1)**	**(2)**
18(c)(i)	Material returns to its original shape (and size) once (deforming) force removed	**(1)**	**(1)**
18(c)(ii)	An oscillating system is driven/forced at its natural frequency There is a maximum transfer of energy Resulting in an increasing/maximum amplitude of oscillation	**(1)** **(1)** **(1)**	**(3)**
18(c)(iii)	**Max 2:** The frequency of oscillation of the wings is a multiple of the muscle frequency Impulses are always applied at the same point in the cycle (of the wing's oscillation) So there will still be an efficient transfer of energy from the muscles to the wings [dependent upon either MP1 or MP2]	 **(1)** **(1)** **(1)**	**(2)**
	Total for Question 18		**13**