Name of the Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable answers		Additional guidance	Mark
(i)	• Use of cos θ = vertical force ÷ applied force • Answer 55 N	(1) (1)	Example of calculation cos θ = 50 N ÷ F F = 55.2 N	2

Question Number	Acceptable answers		Additional guidance	Mark
(ii)	• Correct use of trigonometrical function to determine force in direction of motion • Use of $W = Fs$ **and** $P = W/t$ **Or** use of $v = s/t$ **and** $P = Fv$ • P = 83 W	(1) (1) (1)	MP3 allow ecf from (b)(i) Example of calculation F = 55.2 N × sin 25° = 23.3 N $P = \frac{23.3\ \text{N} \times 15\ \text{m}}{4.2\ \text{s}}$ = 83.2 W	3

Q2.

Question Number	Acceptable Answer	Additional Guidance	Mark
	• Uses scale 1:10 **(1) OR** determines the ratio of lengths from the diagram **(1)** • Use of moment equation for tooth force = force × (perp) distance **(1)** • Use of moment equation for muscle force = force × sin (angle with jaw) × (perp) distance **(1)** • Moment of tooth force = moment of muscle force **(1)** • Muscle force = 24 000 N **(1)**		5

Q3.

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Question Number	Acceptable Answer	Additional Guidance	Mark
	• use of $\Delta E_{grav} = mg\Delta h$ and use of $P = VI$ **(1)** • correct use of time **(1)** • efficiency = 0.816 or 81.6 % **(1)**	Example of calculation: ΔE_{grav} = 800 kg × 9.81 m s^{-2} × 14 m/s = 109900 J P = 230 V × 13.0 A = 2990 W E = Pt = 2990 W x 45 s = 134600 J efficiency = 109900 J/134600 J = 0.816 Alternative calculation: $\text{Efficiency} = \frac{(800\ \text{kg} \times 9.81\ \text{N kg}^{-1} \times 14\ \text{m})/45.0\ \text{s}}{230\ \text{V} \times 13.0\ \text{A}} = 0.816$ Accept rounding variations if alternative calculation method used.	**3**

Q4.

Question number	Acceptable answers	Additional guidance	Mark
	• Uses weight of displaced air = ρVg **(1)** • Finds resultant force = upthrust – weight **(1)** • Uses F = ma to find acceleration **(1)** • Acceleration = 0.161 m s^{-2} **(1)**	Example of calculation: Weight of air displaced = ρVg = 1.20 kg m^{-3}×2880 m^3× 9.81m s^{-2} = 33 903N Resultant upward force = 33 903 N – (3400 kg × 9.81m s^{-2}) = 549 N Acceleration = 549 N/3400 kg = 0.161 m s^{-2}	**4**

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