Name of the Student:_____

Max. Marks : 13 Marks **Time : 13 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable Answers		Mark
(a)(i)	Use of $E_{grav} = mgh$	**(1)**	
	$E_{grav} = 48 \times 10^3$ J	**(1)**	**2**
	Example of calculation Work done = 810 kg × 9.81 N kg^{-1} × 6.0 m Work done = 47 700 (J)		

Question Number	Acceptable Answers		Mark
(a)(ii)	(useful) energy transferred = 0.4 × total energy transferred	**(1)**	
	Use of work done against resistive forces of the ground = $F\Delta s$	**(1)**	
	Force = 9.5 / 9.6 × 10^4 N (ecf) (ignore any −)	**(1)**	**3**
	(It is possible to calculate v from K.E., then a and use $F = m\,a$)		
	Example of calculation Useful energy transferred from driver = $\frac{40}{100} \times 47\,700\ \text{J} = 19\,100\ \text{J}$ Resistive force = $\frac{19100\,\text{J}}{0.20\,\text{m}} = 9.6 \times 10^4\ \text{N}$		

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Question Number	Acceptable Answers	Mark
(b)(i)	Use of Stress = $\frac{\text{force}}{\text{area}}$ **Or** Use of Strain = $\frac{\text{extension}}{\text{original length}}$ **(1)** Correctly use $E = \frac{\text{stress}}{\text{strain}}$ with $E = 120\ (\times 10^6)$, $F = 7(\times 10^5)$, $x = 0.4$ correctly substituted **(1)** (Use of $E = (F \times x) / (A \times \Delta x)$ scores MP1 for quoting formula and MP2 for 'use of') $\Delta x = 0.008(3)$ (m) **(1)** Example of calculation $\sigma = \frac{7.0\times10^5\,\text{N}}{\pi\times(0.30\text{m})^2} = 2.48\times10^6\,\text{Pa}$ $\varepsilon = \frac{\Delta x}{0.40\ \text{m}}$ $\Delta x = \frac{2.48\times10^6\,\text{Pa}\times0.40\text{m}}{120\times10^6\,\text{Pa}}$ Δx (compression) = 0.0083 (m)	**3**

Question Number	Acceptable Answers	Mark
(b)(ii)	Use of $E_{el} = \frac{1}{2}F\Delta x$ **(1)** Energy stored = 2.8×10^3 J or 2.9×10^3 J (ecf) **(1)** Example of calculation $E_{el} = \frac{1}{2} \times 7.0 \times 10^5\ \text{N} \times 0.0083\ \text{m}$ $E_{el} = 2.9 \times 10^3$ J	**2**

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Question Number	Acceptable Answers	Mark
*(b)(iii)1.	**(QWC – work must be clear and organised in a logical manner using technical terminology where appropriate)** [Only apply if both 1. and 2. get full marks] <u>Graph:</u> Permanent/plastic compression/deformation **Or** does not return to its original length/shape **(1)** <u>Effect:</u> Becomes too thin **Or** will not compress **Or** no longer elastic **Or** becomes brittle **(1)**	**2**

Question Number	Acceptable Answers	Mark
*(b)(iii)2.	More work done in loading than unloading the wood **Or** more energy is absorbed/stored than released **Or** the area between the lines shows energy is dissipated **Or** the area while applying the force > the area while releasing **Or** (the area in) the hysteresis loop shows energy is dissipated **(1)** (these should be marked if written in 1. above)	**1**
	Total for question	**13**

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