Merit Minds
www.merit-minds.com
Exam Preparation and Free Resources

Name of the Student:_____

Max. **Marks : 17 Marks**   Time : 17 Minutes

Mark Schemes

Q1.

Question Number	Acceptable answers		Additional guidance	Mark
	• states wavelength = 1.2 cm	(1)	Example of calculation: $\lambda = 4.8 \times 0.25$ cm $= 1.2$ cm	
	• use of E = stress / strain	(1)	$A = \pi d^2 / 4$ $= \pi(3.6 \times 10^{-6}\,\text{m})^2 / 4$ $= 1.012 \times 10^{-11}\,\text{m}^2$	
	• use of $A = \pi d^2/4$	(1)	stress = strain $\times E = 9.7 \times 10^{-9} \times 1.2 \times 10^9$ N m^{-2}	
	• use of stress = F/A	(1)	$= 11.64$ N m^{-2} $T = F$	
	• use of $v = \sqrt{(T/\mu)}$	(1)	= stress $\times A = 11.64$ N m$^{-2} \times 1.012 \times 10^{-11}$ m$^2 = 1.18 \times 10^{-10}$ N	7
	• use of $v = f\lambda$ with any two of the stated / measured / calculated values of v, f or λ to calculate the other	(1)	$v = \sqrt{(\ \div\ )} = \sqrt{8.92 \times 10^{-3}} = 0.094$ m s^{-1} Using $v = f\lambda$, $v = 7.9$ Hz $\times 0.012$ m $= 0.0912$ m s^{-1}	
	• comparison of this calculated value of v, f or λ with the value obtained another way	(1)	Agree to within 3%, so suggests consistent	

Q2.

Question Number	Acceptable Answer		Additional guidance	Mark
(i)	• Use of $V = \frac{4}{3}\pi r^3$	(1)		
	• Use of $\rho = \frac{m}{v}$ and $U = mg$	(1)		
	• 1.73×10^{-5} (N)	(1)	Example of calculation $$U = \frac{4}{3}\pi \left(\frac{1.5 \times 10^{-8}}{2}\right)^3 \times 997 \times 9.81$$ $$U = 1.73 \times 10^{-5}\ \text{N}$$	3
(ii)	• Use of $F = 6\pi r\eta v$	(1)		
	• $1.1\ \text{m s}^{-1}$ (ecf from (a)(i))	(1)	Example of calculation $$1.73 \times 10^{-5}\ \text{N} = 6\pi \times 0.0011 \times \left(\frac{1.5 \times 10^{-8}}{2}\right)v$$ $$v = 1.1\ \text{m s}^{-1}$$	2

Q3.

Question Number	Acceptable Answers		Additional guidance	Mark
	• Young modulus of steel > young modulus of wood **Or** steel is stiffer **Or** greater stress for a given strain **Or** less strain under the same stress	(1)	Answers must a comparison between steel and wood	
	• So there are less changes in dimensions under a given force for steel	(1)	Accept deformation for changes in dimension	
	• Breaking stress of steel > breaking stress of wood **Or** steel is stronger **Or** steel withstands greater forces without breaking	(1)	MP3 accept UTS steel > UTS wood	
	• steel can withstand a larger force/weight than wood of the same (cross-sectional) area **Or** Under the same force/weight steel can have a smaller (cross-sectional) area than wood	(1)		5
	• Steel coasters can be built that withstand the larger forces from faster cars **Or** (taller tracks can be built because) steel tracks can have smaller dimensions	(1)		