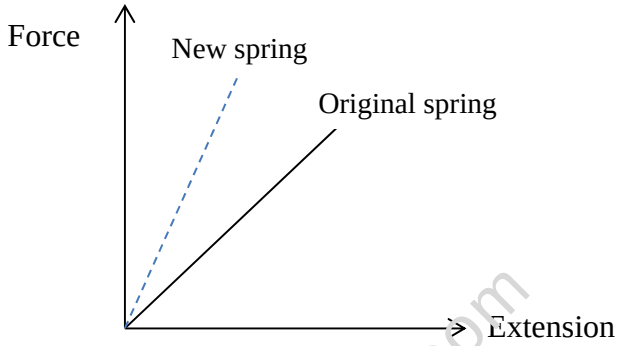
Question Number	Answer	Mark
1	Use of $\sigma = \frac{F}{A}$ (1) Use of cross sectional area = πr^2 **and** d = 2r (1) Diameter = 1.6×10^{-3} m (1) Example of calculation 500×10^6 Pa $= \frac{950\text{ N}}{A}$ A = 1.9×10^{-6} m^2 Diameter = $\sqrt{\frac{4 \times (1.9 \times 10^{-6}\text{ m}^2)}{\pi}}$ Diameter = 0.00156 m	**3**
	Total for Question	**3**

Question Number	Answer	Mark
2(a)	Copper is malleable (1) Can be hammered/beaten/bent into shape (1)	**2**
2(b)	Steel is stiff **Or** steel has a high Young modulus (1) Does not bend / deform (1) (If neither MP is scored then strong **Or** high UTS scores MP1 only)	**2**
	Total for Question	**4**

Question Number	Answer	Mark
3(a)(i)	Less compression / extension / Δx (**must be comparative**) (1) Driver / passenger less comfortable **Or** driver / passenger feels the shock **Or** car body not kept at the same level **Or** the drive is more bumpy. (1)	**2**
3(a)(ii)	Straight line starting from (0,0) above the original line (1)  	**1**
3(b)	Use of $F = k\Delta x$ (1) $(\Delta)x = 0.316 - 0.205$ (= 0.111 m) stated or implied (allow −ve here only) (1) $k = 3.67 \times 10^4$ N m^{-1} (1) Example of calculation $\triangle x = 0.316$ m – 0.205 m = 0.111 m 4.07×10^3 N = $k \times 0.111$ m $k = 3.67 \times 10^4$ N m^{-1}	**3**
	Total for Question	**6**

Question Number	Answer	Mark
4(a)(i)	The increase in extension is constant for a fixed increase in mass **Or** mass is proportional to extension **Or** extension is proportional to mass **Or** graph is a rising/increasing straight line **(1)** The wire obeys Hooke's law **(1)**	**2**
4(a)(ii)	Use of area under the graph **Or** use of ½ $F\Delta x$ (with m or F) **(1)** Identify that the limit of proportionality is at 2.6 ± 0.1 kg **(1)** Elastic potential energy = 0.5 J **(1)** (accept 0.40 J to 0.50 J) Example of calculation Area under the graph = ½ × 3.5×10^{-2} m × 2.6 kg = 0.046 kg m Area × g = 0.046 kg m × 9.81 N kg^{-1} Elastic potential energy = 0.45 J	**3**
4(a)(iii)	The wire will experience a large (increase in) extension/strain for a small (increase in applied) force/stress/mass **(1)** The wire will not return to its original length/shape (once the force is removed) **Or** the wire will be permanently deformed **Or** the wire will exhibit plastic deformation/behaviour **(1)**	**2**
4(b)(i)	Thinner wire **Or** smaller CSA/ diameter/radius **Or** longer wire **Or** wire with a lower stiffness/k/spring constant **Or** wire that is more ductile **Or** wire with a lower Young modulus **(1)** (comments must be comparative)	**1**
4(b)(ii)	**Max 2** Use a pointer on the wire/masses **(1)** Sensible suggestion to reduce parallax e.g. read at eye level **Or** place the rule as near as possible to the mass/wire **(1)** Use a set square to ensure rule is vertical **(1)** Wait for the extension to finish **(1)** Add masses gently **(1)**	**2**
	Total for question	**10**