1)

(a)		A quantity that has (both) magnitude / size and direction	**B1**	**Not** 'A quantity that has direction'
(b)		Circled /underlined quantities are: acceleration, displacement and weight	**B1**	**Note**: All three need to be identified for a mark

2)

Lines joining density to 'kg m^{-3}' pressure to 'kg m^{-1} s^{-2}' power to 'kg m^2 s^{-3}'	B1×2	**Note**: All correct – 2 marks, deduct 1 mark for each error or omission. (Minimum score = 0)
Total	**2**	

3)

a	10^6 nano (n) 10^{12}	B1 B1 B1	**Allow**: 1000 000 **Allow**: nano / n / nano (N) as BOD **Allow**: 1000 000 000 000
b	Circled quantities: density and volume	B1	

4)

(a)		Correct lines from: • joule (J) to N m • watt (W) to J s^{-1} • newton (N) to kg m s^{-2}	B2	**Note**: 2 marks for all correct 1 mark for two correct 0 marks for none or one correct
(b)	**(i)**	weight in the range 200 to 1200 (N)	B1	
	(ii)	area in the range 0.01 to 0.08 (m^2)	B1	
	(iii)	pressure = (b)(i)/b(ii)	B1	**Allow**: 1 sf answer
		Total	**5**	

5)

a	work done → N m stress → N m^{-2} density → kg m^{-3}	B2	**Allow** 2 marks if all correct **Allow** 1 mark if one or two responses are correct
b(i)	weight / gravitational force	B1	**Not** 'gravity'
b(ii)	(force =) 4.8 × 9.81 (= 47.1 N) pressure = $\frac{4.8 \times 9.81}{0.085 \times 0.085}$ pressure = 6.52 × 10^3 (Pa)	C1 A1	**Note:** 2 marks for bald 2 sf answer of 6.5 × 10^3 (Pa) **Allow** 1 mark for '48/0.085^2 = 6.64 × 10^3'; *g* taken as 10 (N kg^{-1}) **Allow** 1 mark for '4.8 × 9.81/8.5^2 = 0.65' **Not** 'mass/area' since it is 'wrong physics'.
b(iii)	8 4 2	B1 B1 B1	This must be consistent with the values for mass and cross-sectional area.
	Total	**8**	

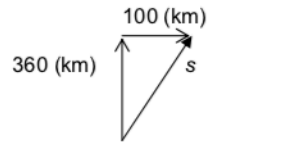
6)

a	**i**	work (done) / (elastic potential) energy	B1	**Not:** heat / gravitational potential energy / kinetic energy
	ii	displacement / distance	B1	
b		Any <u>two</u> from: • Torque (of a couple) • Moment (of a force) • Work (done) / energy	B1×2	**Not**: 'Couple' for 'torque' **Allow**: PE / KE
		Total	**4**	

7)

(a)		A vector quantity has <u>direction</u> / scalar quantity does not have <u>direction</u>	B1	**Not**: 'Scalar only has magnitude' because there is no mention of <u>direction</u>
(b)	(i)	acceleration	B1	
	(ii)	power <u>and</u> energy	B1	
	(iii)	stress <u>and</u> pressure unit: pascal / Pa / N m^{-2} / kg m^{-1} s^{-2}	M1 A1	**Note**: The A1 mark can only be scored if M1 is awarded
(c)		10^{12}	B1	
(d)		*p μ c k*	B1	
		Total	**7**	

8)

(a)	**(i)**	Both measured in metre/m	B1	**Allow**: Both have the same unit/Both have 'magnitude' **Not**: Both are distance/length
	(ii)	Distance is a scalar/does not have direction or Displacement is a vector/has direction	B1	**Not**: One is a vector and the other a scalar
(b)	**(i)**	time = $\frac{3.6\times10^{5}}{170}$ time = 2.1(18) × 10^3 (s) or 2.1 × 10^3 (s)	B1	**Note**: Answer to 2sf or more is required
	(ii)	Correct vector triangle Eg:  $s^2 = 360^2 + 100^2$ / $s = \sqrt{(360^2 + 100^2)}$ s = 373.6 (km) / 370 (km)	B1 C1 A1	The vector triangle must have at least two labels (360, 100 and *s* – allow *x* or *d* for *s*). The 'orientation' of the triangle must be as shown. Ignore the direction of the arrows. **Allow**: Full credit can be given for a scale drawing 2 marks if answer in the range (370 – 380) 1 mark if answer in the range (360 – 370) or (380 - 390) **Note**: Bald answer to 2sf or more and no diagram scores 2/3 marks.
		Total	**6**	

9)

(a)		N m^{-2} or N/m^2 or Pa m s^{-2} or m/s^2 or (kg) m s^{-2} 1000	B2	**Allow** any prefix given **Allow**: 2 marks if all three correct; 1 mark if one is correct or two are correct
(b)		(volume =) 82 - 75 (cm^3) or 7 (cm^3) density = $\frac{1.6\times10^{-2}}{7\times10^{-6}}$ density = 2.3 × 10^3 (kg m^{-3})	C1 A1	 **Allow**: 1 mark for 2.3 × 10^n, n ≠ 3
		Total	**4**	

10)

a		velocity against time	B1	**Not** 'speed' for velocity **Not** time against velocity Ignore units
b		stress against strain	B1	Ignore units
c		force / load / tension against length (of wire)	B1	**Not** force against extension **Not** 'weight' for force **Not** 'distance' for length Ignore units
		Total	**3**	