

1	<p>(a) any logical method e.g. extension is 2 cm for 8 N or 1 cm for 4 N final extension is 3 cm need 12 N to extend to 6 cm</p>	<p>C1 C1 A1</p>
	<p>(b) (i) shown on diagram: distance from pivot to F OR value of weights OR dist from weights to pivot</p>	<p>B1</p>
	<p>(ii) force/weight of load \times distance from pivot to force (accept symbols if clear)</p>	<p>B1</p>
		[Total: 5]

2	<p>any closed triangle or parallelogram forces in correct directions relative to each other correct resultant indicated resultant 7.7 N to 8.1 N scale stated resultant vertically upwards</p>	<p>C1 C1 C1 A1 4 B1 B1 2 [6]</p>
---	---	---

3	<p>(a) limit of proportionality (allow elastic limit)</p>	<p>B1 [1]</p>
	<p>(b) force is proportional to extension or in terms of doubling</p>	<p>B1 [1]</p>
	<p>(c) (up to Q extension proportional to force applied) Q to R extension/unit force more however expressed</p>	<p>B1 [1]</p>
	<p>(d) $k = \text{force/extension}$ or $8/2$ or other correct ratio $= 4.0 \text{ N/mm}$</p>	<p>C1 A1 [2]</p>
		[Total: 5]

4	(a)	in a straight line or (vector) has direction	B1	1
	(b)	$f = ma$ or $f = 3.0 \times 2.0$ $= 6(0) \text{ N}$	C1 A1	2
	(c)	$P = F/a$ or $P = 120/0.05$ $= 2400 \text{ N/m}^2$ (or Pa)	C1 A1	2 [5]

5	(a)	upwards force = downwards force or no resultant force opposing moments equal or A.C.M. = C. M.	B1 B1	[2]
	(b)	30 x spring balance reading = 40 x 6.0 or equivalent spring balance reading = 8.0 N	C1 A1	[2]
	(c)	0.5 N downwards	B1 B1	[2] Total [6]

6	(a)	(i)	Extension proportional to load however expressed	B1	[7]
		(ii)	Any relevant arithmetic to show direct proportion (or straight line graph <u>with values</u>)	B1	2
	(b)	(i)	Work done = force x distance / 400 x 0.210	C1	4 [6]
			84.0 J	A1	
		(ii)	(total) work/time or (24 x) 84/60 (apply e.c.f from (i))	C1	
			33.6 W	A1	

7	<p>(a) (i) force of gravity acts on masses/weight of masses (ii) vector has direction/force has direction</p>	<p>B1 B1</p>	<p>2</p>
	<p>(b) (i) spring 1 (more difficult) any correct relevant pair of values (ii) P marked at extension 25 mm to 28 mm explanation in terms of end of proportionality (iii) each graph read at 15 N, approx. 25 mm, 19 mm difference correct, 6 mm +/- 1 mm</p>	<p>M1 A1 A1 B1 C1 A1</p>	<p>6 [8]</p>
8	<p>(a) attempt to use triangle or parallelogram of forces stated scale used 950 N and 1220 N in correct relative directions correct resultant drawn in weight = 1785 N [limits 1700 N to 1850 N]</p>	<p>M1 A1 C1 C1 A1</p>	<p>5</p>
	<p>(b) (i) work = force x distance or 1500 x 3.0 work = 4500 J (ii) power = work/time or 4500/2.5 power = 1800 W</p>	<p>C1 A1 C1 A1</p>	<p>4 [9]</p>