Q1	(a)(i)	scalar named	B1
		has (only) magnitude / size / value (not quantity)	B1
	(ii)	vector named	B1
		has magnitude and direction	B1
		allow one out of two for a vector has direction and a scalar does n	ot
	(b)(i)	speed = distance / time or distance = speed x time	C1
		distance = 25 x 7.6	
		= 190 (m)	A1
	· (ii)	displacement shown as a straight line from A and B	B1
	(iii)	velocity is a vector or has a direction / speed is a scalar or does no	ot
		have a direction	B1
		direction of (the velocity) changes / car changes direction	B1
	(iv)	triangle showing correct orientation of the vectors	B1
		V	

 $v_B - v_A = [(25)^2 + (25)^2]^{1/2}$ / scale given for triangle C1 = 35.4 (m s⁻¹) / 34 to 37 (m s⁻¹) if clearly a scale diagram A2 penalise (-1) for any further subtraction of this value (e.g. 35 – 25)

(v) acceleration is a change in velocity / car has a change of velocity / car has a change in direction
 car is accelerating
 B1
 TOTAL [15]

Final Mark Scheme 2821/0		eme 2821/01	June 2004
(depend	energy due to position / height / above the ground ds on gravitational field strength / weight n / wh B1 and symbols defined as mass, gravitational field strength and height / weight and height B1	B1 B1
	(ii)	energy due to movement / motion	B1
	• •	depends on mass and speed or ½mv² B1 and symbols defined B1	B 1
	(iii)	work is the rate of doing work or rate of using energy (work done/time taken)	B1
ı	(b)(i)	pe = ke / mgh = $\frac{1}{2}$ mv ²	C1
. '	(~/\./	$9.81 \times 130 = 0.5 \times v^2$	C1
		$v = 50.5 \text{ m s}^{-1}$ (allow 50 or 51) allow the use of $v^2 = u^2 + 2as$	A1
	(ii)	mgh / t = 110000 m/t = 110000 / (9.81 x 130)	C1
		$= 86.3 (kg s^{-1})$ allow 86	A1
		unit kg s ⁻¹ or kg	B1

(iii) not all the pe of water will be converted to ke friction of water with ground or air resistance not all the ke of water will be converted to ke of the wheel, the water retains some ke friction in the rotation of the wheel not all ke converted to electrical energy friction in the generator not all ke converted to electrical any two

B2
TOTAL [13]

Q3	(a)	weight / gravitational force Branch B	
	(b)	W = (55 + 75) x 9.81 = 1275 (N) (allow 1280)	1
	(c)(i)	F = ma T - 1275 = (130) x 0.55	1
	(ii)	T = 1346.5 (N) (allow 1350) A'T - W = 0 C'T = W = 1275 (N)	1
	(d)	T - W = ma $1240 - 1275 = 130 \times a$ $a = (-) 0.27 \text{ m s}^{-2}$	
	(e)	line with constant positive gradient from origin horizontal line (above zero) line of constant negative gradient at end taking more time than the first section (allow ecf from acceleration value in part (d)	1

TOTAL [12]

Final Mark Schen		eme 2821/01			June 200	
Q4	(a)	(E) = stress/strain			B1	
	(b)(i)	strain = extension/length = 4.2 x 10 ⁻³ / 0.75			C1	
		$= 5.6 \times 10^{-3}$			A1	
	(b)(ii)	E = force / (area x strain) F = E x A x strain			C1	
		$= 2 \times 10^{11} \times 4.5 \times 10^{11}$	⁻⁷ x 5.6 x 10 ⁻³	3	C1	
		= 504 (N)	4		A1	
	(c)	larger extension in words score (twice the extension) 8.4	es 1 scores 2		B2	
	(d)(i)	density = mass / volume	,00100 <u>2</u>		B1	
	(ii)	volume larger hence density le	ess		B1	
	("'/	Volumo largor nonco donon, la			Total [10]	
Q5	(a)	engine provides turning effect Tyre pushes back on the ground Ground pushes on the tyre Friction between tyre and ground Force on tyre is (unbalanced) Example of Newton's third law	ind ind in the forward	d direction		
				Max 4	В4	
,	(b) acceleration needs forward force on car friction enables forward push from road on the tyres effect greatly reduced if the road surface is e.g. wet (suitable comn effect due to road surface) comment on tyre surface tread and its effect faster car is travelling greater air resistance and less acceleration					
	deceleration needs force to oppose / backwards to motion friction between brakes and wheel friction due to road and tyres friction in bearings friction from air resistance					
		max 3 from each part	and	Max 4 in tota	I B4	
		Spelling, punctuation and g	rammar		B 1	
		Use of technical language			B1 TOTAL [10]	