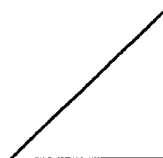
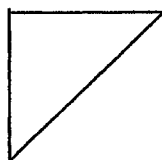


- Q1**
- (a)(i)** scalar named **B1**  
has (only) magnitude / size / value (**not** quantity) **B1**
- (ii)** vector named **B1**  
has magnitude and direction **B1**  
allow one out of two for a vector has direction and a scalar does not
- (b)(i)** speed = distance / time or distance = speed x time **C1**
- distance =  $25 \times 7.6$   
= 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 not have a direction **B1**  
direction of (the velocity) changes / car changes direction **B1**
- (iv)** triangle showing correct orientation of the vectors **B1**



$$v_B - v_A = [(25)^2 + (25)^2]^{1/2} \quad / \text{ scale given for triangle} \quad \mathbf{C1}$$

$$= 35.4 \text{ (m s}^{-1}\text{)} \quad / \quad 34 \text{ to } 37 \text{ (m s}^{-1}\text{)} \text{ if clearly a scale diagram} \quad \mathbf{A2}$$

penalise (-1) for any further subtraction of this value (e.g. 35 – 25)

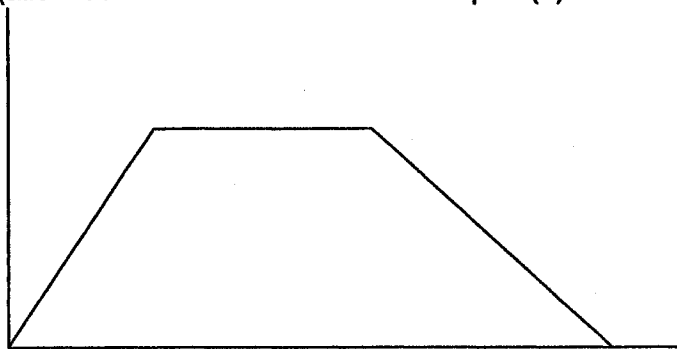
- (v)** acceleration is a change in velocity / car has a change of velocity / car has a change in direction **B1**  
car is accelerating **B1**

**TOTAL [15]**

- Q2**
- (a)(i)** energy due to position / height / above the ground **B1**  
 depends on gravitational field strength / weight **B1**  
 or  $mgh$  /  $wh$  **B1** and symbols defined as mass, gravitational field strength and height / weight and height **B1**
- (ii)** energy **due to** movement / motion **B1**  
 depends on mass and speed **B1**  
 or  $\frac{1}{2}mv^2$  **B1** and symbols defined **B1**
- (iii)** work is the rate of doing work or rate of using energy **B1**  
 (work done/time taken)
- (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) **A1**  
 allow the use of  $v^2 = u^2 + 2as$
- (ii)**  $mgh / t = 110000$  **C1**  
 $m/t = 110000 / (9.81 \times 130)$   
 $= 86.3 \text{ (kg s}^{-1}\text{)}$  allow 86 **A1**  
 unit  $\text{kg s}^{-1}$  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  
tension **B1**  
**B1**
- (b)  $W = (55 + 75) \times 9.81 = 1275 \text{ (N)}$  (allow 1280) **A1**
- (c)(i)  $F = ma$  **C1**  
 $T - 1275 = (130) \times 0.55$   
 $T = 1346.5 \text{ (N)}$  (allow 1350) **A1**
- (ii)  $T - W = 0$  **C1**  
 $T = W = 1275 \text{ (N)}$  **A1**
- (d)  $T - W = ma$  **C1**  
 $1240 - 1275 = 130 \times a$  **A1**  
 $a = (-) 0.27 \text{ m s}^{-2}$
- (e) line with constant positive gradient from origin **B1**  
horizontal line (above zero) **B1**  
line of constant negative gradient at end taking more time than the first section **B1**  
(allow ecf from acceleration value in part (d))

**TOTAL [12]**

