Question 1

(a) (i) Linear distance between two points in a specific direction --- [B1]

(ii) Rate of change of displacement --- [B1]

(iii) Rate of change of velocity --- [B1]

(b) (i) area under graph

(1/2 x 4 x 10) + (1/2 x 3 x 10) + ½(7 +4)x 5 --- [C1]

= 62.5 m --- [A1]

(ii) 35.0 – 27.5 --- [C1]

= 7.5 m --- [A1]

(iii) total displacement / total time = 7.5 / 14 --- [C1]

= 0.54 ms^{-1} --- [A1]

Question 2

(a) (i) measurement to be consistently shifted in one direction only

(ii) results to be scattered about the mean value

(b) (i) 1/279 = 0.0036 --- [A1]

(b) (ii) 1/202 x 100% = 0.50 % --- [A1]

(b) (iii) Area = 279 x 202 = 56358 mm^2 --- [C1]

ΔA = (1/279 + 1/202) x 56358 = 481 = 500 (1 s.f.) --- [C1]

Area = (56000 ± 500) mm^2 --- [A1]

Question 3

(a) (i) Power = $m_{total}gh / t$ = (75 + 15) x 9.81 x 0.25 x 40 / 10 --- [C1]

= 882 W --- [A1]

(a) (ii) Power = $m_{bricks}gh / t$ = 15 x 9.81 x 10 / 10 --- [C1]

= 147 W --- [A1]

(a) (iii) 147 / 882 x 100% --- [C1]

= 16.7 % --- [A1]

(b) (i) P = Fv = 15 x 9.81 x 0.8 --- [C1]

= 117.6 W --- [A1]

(b) (ii) He is not raising his own body weight this time --- [B1] OR

Lesser power is used to do the work --- [B1]

Question 4

(a) ratio of stress to strain --- [B1]

(b) (i) To compensate the sagging of the support OR change in length due to temperature change --- [B1]

(b) (ii) To allow for large / significant extension OR large strain --- [B1]

(c) Measure length L, measure radius r and determine area A --- [B1]

Vary the load and measure the individual extension --- [B1]

Tabulate stress = F/A and strain = ext / original length and plot graph of stress vs strain --- [B1]

Gradient of the graph represent the Young Modulus --- [B1]

Question 5

(a) (i) $d = 1 \times 10^{-3} / 455 = 2.20 \times 10^{-6}$ m --- [A1]

(a) (ii) $d \sin \theta = n\lambda$, --- [C1]

$\lambda_{red} = 5.99 \times 10^{-7}$ m --- [A1]

$\lambda_{violet} = 4.50 \times 10^{-7}$ m --- [A1]

(b) (i) $d \sin \theta = n_{violet}(4.50 \times 10^{-7})$

$d \sin \theta = n_{red}(5.99 \times 10^{-7})$ } --- [C1]

$n_{red} / n_{violet} = 3 : 4$ --- [A1]

(b) (ii) $(2.20 \times 10^{-6}) \sin \theta = (4)(4.50 \times 10^{-7})$ OR

$(2.20 \times 10^{-6}) \sin \theta = (3)(5.99 \times 10^{-7})$ } --- [C1]

$\theta = 54.8°$ --- [A1]

Question 6

(a) The direction / plane of vibration of the particles in the medium --- [B1] is parallel to the direction of propagation of wave --- [B1]

(b) (i) Maximum intensity at point O --- [A1] Since path difference between waves at O is zero, thus they are in constructive interference. --- [M1]

(b) (ii) Wavelength is halved --- [B1]

so from $x = \lambda D / a$, the distance between consecutive maxima is halved --- [B1]

Minimum intensity at point O since destructive interference occurs. --- [B1]

Pattern remains the same except that the maxima & minima positions has been swapped --- [B1]

Question 7

(a) $P = V^2 / R = 120^2 / 750$ --- [C1]

$= 19.2\ \Omega$ --- [A1]

(b) $R = \rho L / A$

$L = 19.2 \times 1.0 \times 0.05 \times 10^{-6} / 1.1 \times 10^{-6}$ --- [C1]

$= 0.87$ m --- [A1]

(c) another element is connected parallel to the 120 V source.

Question 8

(a) (i) sum of current entering a junction is equals to the sum of current leaving that junction --- [B1]

Based on conservation of charge --- [B1]

(a) (ii) for any closed loop, the sum of emfs is equals to the sum of pds --- [B1]

Based on conservation of energy --- [B1]

(b) $4 = 4I + 2I_1$ --- [B1]

$3 = 4I + I_2$ --- [B1]

$1 = 2I_1 - I_2$ --- [B1]

$I = I_1 + I_2$ --- [B1] … (any 3)