Question 1

(a) $T = 16.0 / 10 = 1.60$ s --- [C1]
$\Delta T = 0.1 / 10 = 0.01$ s --- [C1]
$T = 1.60 \pm 0.01$ s --- [A1]

(b) repeat measurements and find the average OR increase the number of oscillations --- [B1]

(c) rearrange the equation,
$k = 4\pi^2 m / T^2$
$(\Delta k / k)100\ \% = (\Delta m / m + 2\Delta T / T)100\ \%$ --- [C1]
$= 1.5\ \%$ --- [A1]

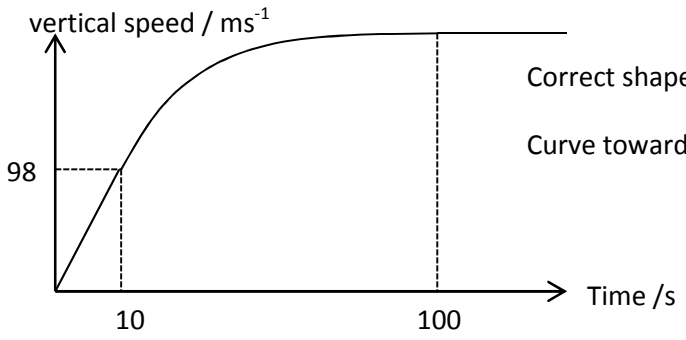
Question 2

(a) rate of change of velocity --- [B1]

(b) (i) $v = u + at = 0 + (9.81)(10)$ --- [C1]
$= 98.1\ ms^{-1}$ --- [A1]

(b) (ii) as speed increases, air resistance increases --- [B1]
(Since weight in constant), resultant force acting downwards decreases --- [B1]
When resultant force decreases to zero, acceleration becomes zero --- [B1]

(b) (iii)



Correct shape with straight line at beginning --- [B1]

Curve towards zero gradient at 100 s --- [B1]

Question 3

(a) $F = PA = (10 \times 10^3 \times 0.2) = 2 \times 10^3$ N --- [A1]

(b) moment = F x d
$= 2 \times 10^3 \times 0.5 = 1000$ Nm --- [A1]

(c) 1000 Nm --- [B1}
since the turbine rotates at constant rate (means resultant moment is zero) --- [B1]

(d) Efficiency = (50 M / 125 M) --- [C1]
= 0.4 or 40 % --- [A1]

(e) Work done against friction in turbine --- [B1]

Question 4

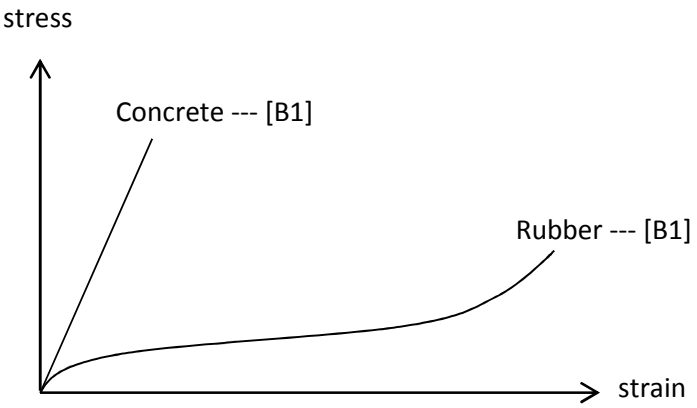
(a) Elastic deformation – return to original length when external force is removed
Plastic deformation – permanent extension even when external force is removed -- [B1]

Elastic deformation – energy stored as a result of work done is fully recoverable
Plastic deformation – energy stored as a result of work done is partially recoverable -- [B1]

(b) (i) Strong / stiff / brittle --- [B1]

(ii) Concrete is an amorphous structure --- [B1]
When tension is applied is greater than the intermolecular forces of the atoms, they will be dislocated / displaced from their original arrangement. Therefore crack occurs when they are too far apart, and eventually it fractures --- [B1]
For compression, the atoms are now displaced closer to each other, thus it is not easily fractured --- [B1]

(c)



Question 5

(a) a wave where the wave profile travels outwardly / propagates throughout the medium --- [B1]
(b) $x = \lambda D / a$ --- [C1]
$= (589 \times 10^{-9})(2.5) / 0.8 \times 10^{-3}$ --- [C1]
$= 1.84 \times 10^{-3}$ m --- [A1]

(c) (i) Red light has longer wavelength --- [B1], since $x \alpha \lambda$, fringe separation increases --- [B1]

(ii) no change in the pattern --- [B1]

Question 6

(a) (i) Force per unit positive charge --- [B1]

(b) $F = qE = (1.6 \times 0^{-19})(2.7 \times 10^{5})$ --- [C1]

$= 4.32 \times 10^{-14}$ N --- [A1]

(c) (i) $w = Fd = (4.32 \times 10^{-14})(0.0078)$ --- [C1]

$= 3.37 \times 10^{-16}$ J --- [A1]

(ii) Gain in K.E = work done = 3.37×10^{-16} J --- [A1]

(iii) $V = Ed = (2.7 \times 10^{5})(0.0078)$ --- [C1]

$= 2106$ V --- [A1]

(iv) A is at higher potential --- [B1]

Question 7

(a) ratio of potential difference to current between two points --- [B1]

(b) (i) $I = P/V = 60/240$ --- [C1]

$= 0.25$ A --- [A1]

(ii) $V = 240/12$ --- [C1]

$= 20$ V --- [A1]

(iii) $R = V/I = 20/0.25$ --- [C1]

$= 80\ \Omega$ --- [A1]

(c) $P = V^2/R = 240^2/(80/12)$ --- [C1]

$= 8640$ W --- [A1]

Question 8

(a))

		α – particles	β – particles	
Charge	:	+ 2e	- e	--- [B1]
Mass	:	6.64×10^{-27} kg	9.11×10^{-31} kg	--- [B1]
Penetration	:	stopped by thin sheet of paper	stopped by 5 mm of Al	--- [B1]

(b) $^{207}_{81}Tl \rightarrow {}^{207}_{82}X + {}^{0}_{-1}e$ --- [B2]