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Question	Answer	Marks
1(a)	F_v : kg m s^{-2}	C1
	k : $\text{kg m s}^{-2} / \text{m} \times \text{m s}^{-1}$ $= \text{kg m}^{-1} \text{s}^{-1}$	
1(b)	$F = \rho g V$	C1
	$V = 4/3 \times \pi \times (2.1 \times 10^{-3})^3$ ($= 3.88 \times 10^{-8} \text{ m}^3$)	
	$\rho = 4.8 \times 10^{-4} / 9.81 \times V$ $= 1300 \text{ kg m}^{-3}$	A1
1(c)(i)	W downwards, U upwards, F_v upwards	B1
1(c)(ii)	$F_v = 7.2 \times 10^{-4} - 4.8 \times 10^{-4}$ $= 2.4 \times 10^{-4} \text{ (N)}$	C1
	velocity $= 2.4 \times 10^{-4} / (17 \times 2.1 \times 10^{-3})$ $= 6.7 \times 10^{-3} \text{ m s}^{-1}$	A1

Question	Answer	Marks
2(a)	force (on droplet of water) in horizontal direction is zero.	B1
2(b)	(time taken \Rightarrow) $3.5 / 6.6 = 0.53 \text{ (s)}$	A1
2(c)	$s = ut + \frac{1}{2}at^2$ $s = \frac{1}{2} \times 9.81 \times 0.53^2$	C1
	$h = 1.4 \text{ m}$	

Question	Answer	Marks
2(d)	displacement is straight-line distance (from P to Q) so less (than distance along path) or displacement is the shortest distance (from P to Q).	B1
2(e)	$(\text{displacement})^2 = 3.5^2 + 1.4^2$	C1
	displacement = 3.8 m	A1

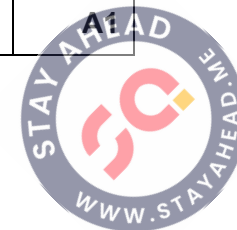
Question	Answer	Marks
3(a)	$(m =) \rho V$	C1
	$= 1.0 \times 10^3 \times 1.5 \times 10^{-4} \times 5.0 \times 1.6 = 1.2 \text{ (kg)}$	A1
3(b)(i)	$(\Delta)p = 1.2 \times 5.0$ $= 6.0 \text{ N s}$	A1
3(b)(ii)	$F = 6.0 / 1.6$ or $1.2 \times 5.0 / 1.6$ $= 3.8 \text{ N}$	A1
3(c)	Newton's third law applies (so) 3.8 N.	B1
3(d)	$p = F / A$ $= 3.8 / 1.5 \times 10^{-4}$	C1
	$= 2.5 \times 10^4 \text{ Pa}$	A1



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Question	Answer	Marks
4(a)	ratio = $300 / 3200$ = 0.094	A1
4(b)	$E = \frac{1}{2}mv^2$ or $E \propto v^2$	C1
	ratio = $(0.094)^{0.5}$ = 0.31	A1
4(c)	work (done against frictional force) = $3200 - 300$ (=2900)	C1
	length = $2900 / 76$ = 38 m	A1
4(d)(i)	$E = \frac{1}{2}kx^2$ or $E = \frac{1}{2}Fx$ <u>and</u> $F = kx$	C1
	$140 = \frac{1}{2} \times 63 \times x^2$ or $140 = \frac{1}{2}Fx$ <u>and</u> $F = 63x$	
	$x = 2.1$ m	A1
4(d)(ii)	percentage efficiency = $(140 / 300) \times 100$ = 47%	A1
4(d)(iii)	curved line from the origin	M1
	gradient of line increases	A1

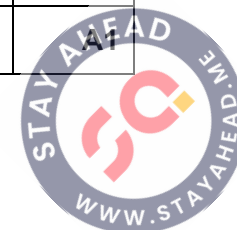
Question	Answer	Marks
5(a)(i)	(two) waves travelling (at same speed) in opposite directions overlap	B1
	waves (of the same type) have same frequency/wavelength	B1
5(a)(ii)	phase difference = 0	A1



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Question	Answer	Marks
5(b)(i)	$f_0 = f_s v / v - v_s$	C1
	$543 = f \times 334 / (334 - 13)$	
	$f = 522 \text{ Hz}$	A1
5(b)(ii)	(the speed is) decreasing	B1
5(c)(i)	$I \propto A^2$	B1
	$I_T / I_0 = \cos^2 20^\circ$ or $A_T / A_0 = \cos 20^\circ$	C1
	ratio = 0.94	A1
5(c)(ii)	angle = 140°	A1

Question	Answer	Marks
6(a)(i)	$P = VI$	C1
	$I = 36 / 8.0$ $= 4.5 \text{ A}$	A1
6(a)(ii)	charge = 4.5×50 $= 225$	C1
	number = $225 / 1.6 \times 10^{-19}$ $= 1.4 \times 10^{21}$	A1
6(a)(iii)	$R = V^2 / P$ or $R = V / I$ or $R = P / I^2$ $= 8.0^2 / 36$ or $= 8.0 / 4.5$ or $= 36 / 4.5^2$	C1
	$= 1.8 \Omega$	A1



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Question	Answer	Marks
6(b)	$R = \rho L / A$	C1
	$L = (1.8 \times 0.25 \times 10^{-6}) / 1.4 \times 10^{-6}$ $= 0.32 \text{ m}$	A1
6(c)	(larger cross-sectional area, same length, same resistivity and so) less resistance	M1
	(same p.d. and more current so) more power (dissipated)	A1
6(d)	current (in wire) is the same	M1
	(same p.d. across wire so) power stays the same	A1

Question	Answer	Marks
7(a)(i)	(electron) neutrino	B1
7(a)(ii)	nucleon number = 22	A1
	proton number = 10	A1
7(a)(iii)	up up down changes to up down down or up changes to down	B1
7(b)(i)	charge = $-\frac{2}{3} e$	A1
7(b)(ii)	antiup / anticharm / antitop	B1

