| Question | Answer | Marks |
|---|---|---|
| 3(a)(i) | work (done) / time (taken) | **B1** |
| 3(a)(ii) | $W = Fx$ **or** $E = Fx$ | **B1** |
| | $(P =)\ Fx / t = Fv$ **or** $P = Fvt / t = Fv$ | **B1** |
| 3(b)(i) | $T = 430 \sin 11°$ **or** $430 \cos 79°$ | **C1** |
| | $= 82$ N | **A1** |
| 3(b)(ii) | speed $= 56 / 82$<br>$= 0.68$ m s$^{-1}$ | **A1** |
| 3(b)(iii) | no change in kinetic energy (of block) | **B1** |
| 3(b)(iv) | (input power) $= 56 / 0.80$<br>$(= 70$ W) | **C1** |
| | time taken $= 1.2 \times 10^3 / 70$<br>$= 17$ s | **A1** |
| | **or** | |
| | (useful energy) $= 1200 \times 80 / 100$<br>$(= 960$ J) | **(C1)** |
| | time taken $= 960 / 56$<br>$= 17$ s | **(A1)** |

| Question | Answer | Marks |
|---|---|---|
| 4(a) | $k = F / \Delta L$ **or** $F / x$ **or** gradient | **C1** |
| | = e.g. 30 / (0.60 – 0.20)<br>= 75 N m$^{-1}$ | **A1** |
| 4(b) | $E = \frac{1}{2}F\Delta L$ **or** $\frac{1}{2}Fx$ **or** $\frac{1}{2}k(\Delta L)^2$ **or** $\frac{1}{2}kx^2$ **or** area under graph | **C1** |
| | $= \frac{1}{2} \times 15 \times 0.20$ **or** $\frac{1}{2} \times 75 \times 0.20^2$ | **C1** |
| | = 1.5 J | **A1** |

| Question | Answer | Marks |
|---|---|---|
| 5(a) | wave(s) (travel along string and) reflect at fixed point / A / B / end | **B1** |
| | incident and reflected waves superpose / interfere<br>**or**<br>two waves travelling / with speed in opposite directions superpose / interfere | **B1** |
| 5(b) | line has an approximate sinusoidal shape with maximum downward displacement at P and zero displacement at each node | **B1** |
| 5(c) | $v = \lambda / T$<br>**or**<br>$v = f\lambda$ **and** $f = 1 / T$ | **C1** |
| | $\lambda$ $= 35 \times 0.040$ **or** $35 / 25$<br>( $= 1.4$ m) | **C1** |
| | distance $= 1.4 \times 2.5$<br>$= 3.5$ m | **A1** |
| 5(d) | (number of periods / cycles) (= $t / T$) $= 0.060 / 0.040$<br>(= 1.5) | **C1** |
| | amplitude $= 72 / 6$<br>$= 12$ mm | **A1** |

| Question | Answer | Marks |
|---|---|---|
| 6(a) | sum of current(s) into junction = sum of current(s) out of junction<br>**or**<br>(algebraic) sum of current(s) at a junction is zero | **B1** |
| 6(b)(i) | same potential difference (across X and Y as in parallel) | **B1** |
| | power = $V^2 / R$ (and $R_X > R_Y$)<br>**or**<br>power = $VI$ **and** $I_X < I_Y$ | **M1** |
| | (so) Y (dissipates more power) | **A1** |
| 6(b)(ii) | $R = \rho L / A$ (and $R_X > R_Y$) | **M1** |
| | (so) Y (has the larger (cross-sectional) area) | **A1** |
| 6(c)(i) | current = 5.4 / 1800<br>= $3.0 \times 10^{-3}$ A | **A1** |
| 6(c)(ii) | 5.4 / 9.0 = 1800 / (1800 + $R_L$)<br>**or**<br>$R_L = (9.0 – 5.4) / 3.0 \times 10^{-3}$ | **C1** |
| | $R_L$ = 1200 Ω | **A1** |
| 6(c)(iii) | resistance of LDR / $R_L$ decreases | **B1** |
| | current (in the circuit) increases (so) voltmeter reading increases | **B1** |

| Question | Answer | Marks |
|---|---|---|
| 7(a)(i) | change in $A$ = 0 | **A1** |
| | change in $Z$ = (+)1 | **A1** |
| 7(a)(ii) | (electron) antineutrino | **B1** |
| 7(b)(i) | up / u (charge) = $(+)\frac{2}{3}e$ **or** antidown / $\bar{d}$ = $(+)\frac{1}{3}e$<br>**or**<br>$(q) = \frac{2}{3}e + \frac{1}{3}e$ | **M1** |
| | $q$ = (+)1$e$ | **A1** |
| 7(b)(ii) | hadron(s) | **B1** |
| | meson(s) | **B1** |