| Question | Answer | Marks |
|---|---|---|
| 10(a) | energy = mcΔT | C1 |
| | energy = ItV<br>$(\Delta T =) \frac{0.40 \times 0.020 \times 75\,000 \times 0.95}{0.015 \times 130}$ | C1 |
| | =290 K | A1 |
| 10(b) | $I = I_o e^{-\mu t}$<br>$0.20 = e^{-0.22t}$ | C1 |
| | t = 7.3 cm | A1 |





| Question | Answer | Marks |
|---|---|---|
| 10(c) | *either*<br>(linear) attenuation coefficients / $\mu$ very different for bone and muscle | M1 |
| | (very) different amounts (of X-rays) absorbed so good contrast<br>or (very) different intensities transmitted so good contrast | A1 |
| | *or*<br>(linear) attenuation coefficients / $\mu$ similar for blood and muscle | (M1) |
| | similar amounts (of X-rays) absorbed so poor contrast<br>or similar intensities transmitted so poor contrast | (A1) |

| Question | Answer | Marks |
|---|---|---|
| 3(a) | $p$ = pressure (of gas), $V$ = volume (of gas) **and** $k$ = Boltzmann constant | B1 |
| | $N$ = number of molecules | B1 |
| | $T$ = thermodynamic temperature | B1 |
| 3(b) | ($pV = NkT$ and $pV = \frac{1}{3}Nm\langle c^2\rangle$ leading to) $NkT = \frac{1}{3}Nm\langle c^2\rangle$ | M1 |
| | algebra leading to $(3/2)kT = \frac{1}{2}m\langle c^2\rangle$ **and** use of $\frac{1}{2}m\langle c^2\rangle = E_K$ leading to $(3/2)kT = E_K$ | A1 |
| 3(c)(i) | $T$ = 296 K | C1 |
| | $\frac{1}{2}m\langle c^2\rangle = (3/2)kT$<br>$\frac{1}{2} \times 5.31 \times 10^{-26} \times u^2 = (3/2) \times 1.38 \times 10^{-23} \times 296$ | C1 |
| | $u$ = 480 m s$^{-1}$ | A1 |
| 3(c)(ii) | line passing through ($P$, $u$) | B1 |
| | horizontal straight line | B1 |