M1.(a) The physical half-life depends only on the properties of the radioactive nuclide ✓

1

biological removal of the nuclide also occurs (thus removing the nuclide more quickly overall) WTTE ✓

1

(b) $A_t = A_o e^{-\lambda t}$ correct sub 1200 = 2700 $e^{-5\lambda}$ ✓

1

(λ_E = ln(2700 / 1200) / 5 = 0.1622)

T_E = ln(2) / 0.1622 = 4.273 ✓

1

1 / 4.273 = 1 / 20 + 1 / T_B ✓

1

T_B = 5.4 days ✓

1

(c) Beta more strongly ionising than gamma so ^{131}I more likely to damage cells / increase radiation dose ✓

1

Gamma rays for ^{131}I are over 4 x more energetic which can cause problems when imaging with a gamma camera ✓

1

190 h >> 6.0 h so with ^{131}I body will remain radioactive for longer posing a greater danger to patient and others he / she in contact with ✓

Half-life of ^{99}T^m may be too short for certain types of diagnosis to be undertaken

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✓

1

Sensible conclusion based on above points ✓

4 marks max

Conclusion may refer to radionuclide ending up at right place in body eg ^{131}I taken up by thyroid, $^{99}T^m$ taken up by bone and red blood cells

1

[10]