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

$(\lambda_E = \ln(2700 / 1200) / 5 = 0.1622)$

$T_E = \ln(2) / 0.1622 = 4.273$ ✓

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

✓

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]