

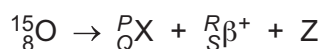
- 8 Oxygen-15 ( $^{15}_8\text{O}$ ) is radioactive and has a half-life of 2.04 minutes.

The decay of oxygen-15 produces positrons. For this reason, oxygen-15 is sometimes used as a tracer in positron emission tomography (PET scanning).

- (a) State what is meant by a tracer.

.....  
 .....  
 ..... [2]

- (b) The equation for the decay of oxygen-15 is



where X is the nucleus formed during the decay and Z is another particle.

- (i) State the values of the integers  $P$ ,  $Q$ ,  $R$  and  $S$ .

$P =$  .....  $R =$  .....  
 $Q =$  .....  $S =$  ..... [2]

- (ii) State the name of particle Z.

..... [1]

- (c) (i) Define the activity of a sample.

.....  
 ..... [1]

- (ii) Calculate the decay constant of oxygen-15. Give a unit with your answer.

decay constant = ..... unit ..... [2]



- (iii) Determine the rate at which positrons are produced in a sample of oxygen-15 that has a mass of  $2.85 \times 10^{-6} \text{ kg}$ .

rate = .....  $\text{s}^{-1}$  [4]

- (d) The particles that are emitted from the body and detected outside it during PET scanning are not positrons but another type of particle.

- (i) State the name of the particles that are detected.

..... [1]

- (ii) Explain how these particles are formed inside the body.

.....  
 .....  
 .....  
 ..... [2]

[Total: 15]