

**Eduqas Physics GCSE**  
**Topic 9.2: Absorption and emission**  
**of ionising radiations and of**  
**electrons and nuclear particles**  
**Mark Schemes for Questions by topic**

1.

(a) Alpha – two protons and two neutrons 1

Beta – electron from the nucleus 1

Gamma – electromagnetic radiation 1

(b) Gamma

Beta

Alpha

*allow 1 mark for 1 or 2 correct*

2

(c) any **two** from:

- (radioactive) source not pointed at students
- (radioactive) source outside the box for minimum time necessary
- safety glasses **or** eye protection **or** do not look at source
- gloves
- (radioactive) source held away from body
- (radioactive) source held with tongs / forceps

*accept any other sensible and practical suggestion*

2

(d) half-life = 80 s 1

counts / s after 200 s = 71

*accept an answer of 70*

1

(e) very small amount of radiation emitted

*accept similar / same level as background radiation*

1

[10]

2.

(a) alpha particles **cannot** pass through...

*do **not** accept gamma particles...*

**or**

alpha particles can pass through a very thin sheet of **paper / card**

*credit answers where correct amendments are made to boxed statement*

1

(b) (i) horizontal and vertical line drawn at correct positions on the graph

*accept a cross drawn at 4500 / 500 on the curve*

**or**

*two pairs of lines drawn, for example, at 600 and 300*

*accept a horizontal line drawn at 500 on its own*

*do **not** accept vertical lines only*

1

(ii) 4500 million years

1

(iii) half-life too long

*do **not** accept simply its half-life is 4500 million years*

1

no (measurable) change in count rate

*do **not** accept have not got the equipment*

*do **not** accept it's harmful (to children)*

*if neither of the above points scored, accept not enough time to measure it for **1** mark*

1

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3.

List A	List B
Type of nuclear radiation	Property of radiation
Alpha	Has the same mass as an electron
Beta	Very strongly ionising
Gamma	Passes through 10 cm of aluminium
	Deflected by a magnetic field but not deflected by an electric field

*if more than 1 line is drawn from any box in List A, none of those lines gain any credit*

3

4.

Question			Answer	Marks
13	(a)	(i)	the average time it takes (1)  for the number of nuclei of an isotope in a sample to halve (1)  <b>or</b>  the time it takes (1)  for the count rate from a sample containing an isotope to fall to half its starting level (1)	2
		(ii)	(idea that) it is not possible to predict when an individual atoms may decay (1)	
	(b)	(i)	calculation of half-life to be 15 minutes (1)	1
		(ii)	so after 3 half-lives counts per minute decreases from 80 to 40 to 20 to 10 (1)  $70/80$ or $7/8^{\text{th}}$ (1)	2
	(c)		Contamination transfers the source / irradiation is emission from the source (1) idea that contamination lasts for a long period of time / irradiation is temporary (1)	2

5.

- (a) (i) *(total) number of protons plus neutrons*  
*accept number of nucleons*  
*accept amount for number*  
*do not accept number of particles in the nucleus*

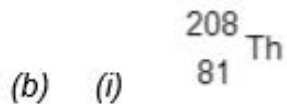
1

- (ii) *number of neutrons decreases by one*

1

*number of protons increases by one  
accept for both marks a neutron changes into a proton*

1



1

*correct order only*

1

(ii) *the number of protons determines the element  
accept atomic number for number of protons*

1

*alpha and beta decay produce different changes to the number of protons  
there must be a comparison between alpha and beta which  
is more than a description of alpha and beta decay alone  
alpha and beta decay produce different atomic numbers  
ignore correct reference to mass number*

1

[7]

6.

(a) (i) *number of protons are the same  
accept atomic number / number of electrons for number of  
protons*

1

*number of neutrons are different  
accept mass numbers are different – only if the first mark is  
awarded*

1

(ii) an electron from the nucleus

*both parts needed*

1

(b) decays at the same rate as it is made

*accept decays as fast as it is made*

*accept absorbed / used by plants (in CO<sub>2</sub>) at same rate as it is being made*

1

(c) (i) 3500

*no tolerance*

1

(ii) adjusted age correctly obtained from the graph

*accept values between 3700–3800 inclusive*

*accept their (c)(i) used correctly to obtain an adjusted age from the graph*

1

adjusted age +50

*second mark can only be scored if first mark awarded*

*if no working shown an answer between 3750–3850 inclusive scores both marks*

*note: any line or mark made on the graph counts as working out*

1

7.

(a) 78 1

(b) atomic 1

(c) (i) 131  
*correct order only* 1

54 1

(ii) 32 (days)  
*allow 1 mark for showing 4 half-lives provided no subsequent step* 2

(iii) *limits amount of iodine-131 / radioactive iodine that can be absorbed*  
*accept increases level of non-radioactive iodine in thyroid*  
*do **not** accept cancels out iodine-131* 1

*so reducing risk of cancer (of the thyroid)*  
*accept stops risk of cancer (of the thyroid)* 1

**[8]**