

Name of the Student: _____

Max. Marks : 18 Marks

Time : 18 Minutes

Mark Schemes

Q1.

(a) mass number stays the same, charge stays the same 1

(b) gamma radiation is only weakly ionising
or
most gamma radiation will pass through any detector
allow gamma radiation is very penetrating 1

(c) any two from

- the radiation spreads out in all directions
- only some of the radiation goes into the G-M tube
- only some of the radiation passing into the GM tube is detected

allow 2 marks for only some of the radiation passing into the GM tube is detected because gamma is weakly ionising 2

(d) to reduce the amount of radiation received
allow to reduce irradiation (of the teacher) 1

because radiation increases the risk of cancer or (genetic) mutation
allow causes cancer or (genetic) mutation 1
ignore references to contamination

(e) a calculation of the product of thickness and count rate
examples of calculations
 $0.5 \times 110 = 55$
 $1.0 \times 60 = 60$
 $1.5 \times 33 = 50$
 $2.0 \times 18 = 36$
 $2.5 \times 10 = 25$ 1

a second calculation of the product of thickness and count rate 1

a comparison of the calculated values and a recognition that they are different 1

OR

A calculation of half the count rate (1)

$$\text{e.g. } \frac{110}{2} = 55$$

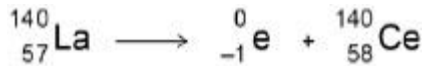
A comparison with the count rate for double that thickness (1)

the first two marks may be scored for a count rate divided by 3, 4 or 5 compared with the corresponding count rate for 3, 4 or 5 times the thickness

A recognition that the values are different (1)

$$\text{e.g. } 55 \neq 60$$

(f)



allow 1 mark for correct numbers on electron

allow 1 mark for correct numbers on Ce

2

(g) half-life = 50 seconds

*this may be indicated on **Figure 3***

1

250 seconds difference in age = 5 half lives

*allow 100 seconds = 2 half lives **and** 350 seconds = 7 half lives*

1

$$\text{ratio} = \left(\frac{1}{2}\right)^5$$

or

$$\text{ratio} = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$$

allow this mark if they have halved $1.25(\times 10^{23})$ five times to get $0.0390625(\times 10^{23})$

for example $1.25(\times 10^{23}) \rightarrow 0.625(\times 10^{23}) \rightarrow 0.3125(\times 10^{23}) \rightarrow 0.15625(\times 10^{23}) \rightarrow 0.078125(\times 10^{23}) \rightarrow 0.0390625(\times 10^{23})$

1

$$\text{ratio} = \frac{1}{32}$$

or

$$\text{ratio} = 1:32$$

allow ratio = 0.031

*allow 32:1 **or** 32*

an answer of $\frac{1}{32}$ or equivalent scores 4 marks

1

(h) tangent drawn on graph

do not allow a line drawn that crosses the graph line

1

$$\text{use of gradient} = \frac{(\Delta \text{ no. of atoms})}{\Delta \text{ time}}$$

values must be taken from their tangent drawn at 20 seconds

1

gradient = $5.3 (\times 10^{21})$ (Bq)
allow gradient =
 $0.053 (\times 10^{23})$ (Bq)
allow a range between
 $4.7 (\times 10^{21})$ (Bq) and $5.9 (\times 10^{21})$ (Bq)

1

[18]