

Mark schemes

- 1.** (a) most alpha particles pass straight through the atom 1
- which shows that the atom is mostly empty space 1
- very few alpha particles are deflected through a large angle 1
- which shows the atom contains a nucleus where the mass / charge of the atom is concentrated 1
- (b) electron may absorb electromagnetic radiation 1
- full credit may be scored for a description of an electron emitting electromagnetic radiation*
- (and) move further from the nucleus 1
- to a higher energy level 1
- [7]**
- 2.** (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]

3.

(a) 2 protons and 2 neutrons

accept 2p and 2n

accept (the same as a) helium nucleus

symbol is insufficient

do not accept 2 protons and neutrons

1

(b) (i) gamma rays

1

(ii) loses/gains (one or more) electron(s)

1

(c) any **one** from:

- wear protective clothing
- work behind lead/concrete/glass shielding
- limit time of exposure
- use remote handling

accept wear mask/gloves

wear goggles is insufficient

wear protective equipment/gear is insufficient

accept wear a film badge

accept handle with (long) tongs

accept maintain a safe distance

accept avoid direct contact

1

[4]

4.

- (a) (i) (atoms with the) same number of protons
allow same atomic number
or same proton number

1

(atoms with) different number of neutrons
allow different mass number

1

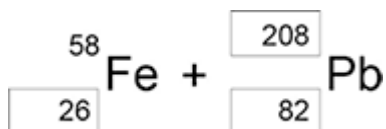
- (ii) 82

1

- (iii) 124

1

- (b) (i)



1 mark for each correct box

3

- (ii) (a) neutron

1

- (iii) 4.0×10^{-4} (s)

or

0.0004

$$3.00 \times 10^8 \times 0.1 = 12\,000 / t$$

gains 1 mark

2

- (iv) particles need to travel a large distance

1

equipment would have to be very long

1

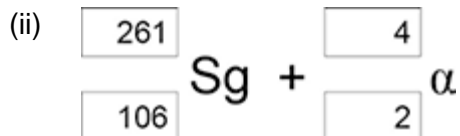
with circular paths long distances can be accommodated in a smaller space

1

(c) (i) the average time for the number of nuclei to halve 1

the time for count rate to halve

1



1 mark if top boxes total = 265

and bottom boxes total = 108

1 mark for 4 and 2 for alpha

2

(d) (i) 3 plotted points

$\pm \frac{1}{2}$ small square

1

best line through points

1

(ii) 190–205 (pm)

or correct from student's line

1

[20]

5.

(a) neutrons and protons

1

(b) 0

1

(+)1

1

(c) (i) total positive charge = total negative charge

accept protons and electrons have an equal opposite charge

1

(because) no of protons = no of electrons

1

(ii) ion

1

positive

1

[7]

6.	(a) (i) neutron	1
	(ii) neutron proton <i>both required, either order</i>	1
	(iii) 2	1
	number of <u>protons</u> <i>do not accept number of electrons</i>	1
(b) (i)	any one from: <ul style="list-style-type: none"> • beta • gamma <i>accept correct symbols</i> <i>accept positron / neutrino / neutron</i> <i>cosmic rays is insufficient</i>	1
	(ii) electrons	1
	(iii) are highly ionising	1
(c) (i)	mutate / destroy / kill / damage / change / ionise <i>Harm is insufficient</i>	1
	(ii) much smaller than	1

[9]