

M1. (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

(d) Marks awarded for this answer will be determined by the quality of communication as well as the standard of the scientific response. Examiners should apply a best-fit approach to the marking.

**0 marks**  
No relevant content

**Level 1 (1 – 2 marks)**  
There is a basic description of at least **one** of the particles in terms of its characteristics.

**Level 2 (3 – 4 marks)**

There is a clear description of the characteristics of **both** particles  
**or**  
a full description of either alpha **or** beta particles in terms of their characteristics.

**Level 3 (5 – 6 marks)**

There is a clear and detailed description of **both** alpha and beta particles in terms of their characteristics.

**examples of the physics points made in the response:**

**structure**

- alpha particle consists of a helium nucleus
- alpha particle consists of 2 protons and 2 neutrons
- a beta particle is an electron
- a beta particle comes from the nucleus

**penetration**

- alpha particles are very poorly penetrating
- alpha particles can penetrate a few cm in air
- alpha particles are absorbed by skin
- alpha particles are absorbed by thin paper
- beta particles can penetrate several metres of air
- beta particles can pass through thin metal plate / foil
- beta particles can travel further than alpha particles in air
- beta particles can travel further than alpha particles in materials eg metals

**deflection**

- alpha particles and beta particles are deflected in opposite directions in an electric field
  - beta particles are deflected more than alpha particles
  - alpha particles have a greater charge than beta particles but beta particles have much less mass
- or**  
beta particles have a greater specific charge than alpha particles

6

[13]

M2.(a) (i) all correct

*accept presented as a tally chart*

Number of protons	3
Number of electrons	3
Number of neutrons	4

*allow 1 mark for 1 correct*

2

(ii) 7

*reason may score even if 7 not chosen*

1

number of protons and neutrons

*accept number of particles in the nucleus*

*accept number of nucleons*

*do **not** accept number of electrons and neutrons*

1

(b) an ion

1

(c) (i) smaller than

1

(ii) radon loses an alpha (particle)

**or**

radon loses an (alpha) particle

**or**

(mass of) polonium plus an alpha = (mass) radon

**or**

radon loses 2 protons and 2 neutrons (to become polonium)

*accept radon has less protons and neutrons*

1

[7]

**M3.** (a) proton  
electron  
neutron  
*all 3 in correct order*  
*allow 1 mark for 1 correct*  
*do not accept letters p, e, n* 2

(b) 4  
*reason only scores if 4 is chosen* 1

number of protons  
*accept number of electrons*  
*accept there are 4 protons and 4 electrons*  
*do not accept there are 4 protons and electrons* 1

(c) The atom loses an electron. 1 **[5]**

**M4.** (a) (i) L 1

(ii) M 1

(b) To make a smoke detector work. 1

(c) 40  
*no tolerance* 1 **[4]**

**M5.** (a) electron(s)

1

(b) 3<sup>rd</sup> box ticked

The model cannot explain the results from a new experiment

1

(c) all three correct

Particle
Proton
Electron
Neutron

*allow 1 mark for 1 correct*

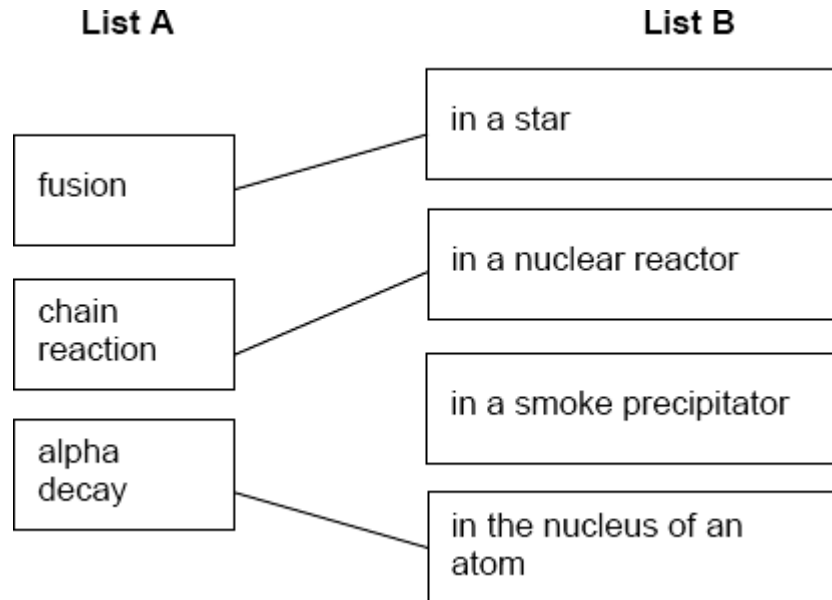
2

[4]

**M6.three** lines correct

*allow 1 mark for each correct line*

*if more than 1 line is drawn from a box in **List A**, mark each line incorrect*



[3]

- M7. (a) (i) neutron 1
- (ii) neutron  
proton  
*both required, either order* 1
- (iii) 2 1
- number of protons  
*do not accept number of electrons* 1
- (b) (i) any **one** from:  
  - beta
  - gamma  
*accept correct symbols*  
*accept positron / neutrino / neutron*  
*cosmic rays is insufficient*
1
- (ii) electrons 1
- (iii) are highly ionising 1
- (c) (i) mutate / destroy / kill / damage / change / ionise  
*Harm is insufficient* 1
- (ii) much smaller than 1

[9]

**M8.** (a) (i) half / 50 % 1

(ii) Measure the radon gas level in more homes in this area 1

(b) (i) 86 1

(ii) 222 1

**[4]**

**M9.(a)** proton

*all 3 in correct order*

electron

*allow 1 mark for 1 correct do **not***

neutron

*accept letters p, e, n*

2

(b) 9

*reason only scores if 9 is chosen*

1

number of neutrons and protons

1

**[4]**



**M10.(a)** neutron discovered

1

(b) neutron

*all 3 in correct order*

electron

*allow 1 mark for 1 correct*

proton

2

**[3]**