Atoms and Isotopes

Mark Scheme 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.4 Atomic Structure
Sub-Topic	Atoms and Isotopes
Difficulty Level	Bronze Level
Booklet	Mark Scheme 1

Time Allowed: **58 minutes**

Score: **/58**

Percentage: **/100**

Grade Boundaries:

M1.(a) 1×10^{-10} m

1

(b) (a helium atom) has 2 electrons

accept it has more mass

allow it is not charged

1

(c) 2

1

(d) neutral

accept 0 or 'no charge'

1

(because) protons have positive charge and electrons have negative charge

1

(and) there are equal numbers of protons and electrons

1

(e) helium will one day run out

1

there will be none left for medical uses so balloons waste helium

1

[8]

M2.(a) (mass number) 231

1

(protons) 92 **1**

(neutrons) 141 **1**

(b) 2 / two (hours) **1**

(because) count rate halves in that time **1**

(c) A high-speed electron **1**

(d) uncontrolled **1**

benign **1**

[8]

M3.(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]

M4.(a) (i) neutron

1

(ii) neutron
proton
both required, either order

1

(iii) 2

1

number of <u>protons</u>
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]

M5.(a) neutron discovered

1

(b) neutron

all 3 in correct order

electron

*allow **1** mark for 1 correct*

proton

2

[3]

M6.(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]

M7. (a) electron(s)

1

(b) 3rd 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]

M8. (a) (i) **L**

1

(ii) **M**

1

(b) To make a smoke detector work.

1

(c) **40**

no tolerance

1

[4]

M9. (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]