

Atoms and Isotopes

Mark Scheme

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

Time Allowed: 43 minutes

Score: /43

Percentage: /100

Grade Boundaries:

M1. (a) L

J

K

*all 3 in correct order
allow 1 mark for 1 correct*

2

(b) number of electrons = number of protons
accept amount for number

1

(c) neutrons
this answer only

1

(d) loses / gains electron(s)

1

[5]

M2. (a) (i) K and L

both answers required either order

1

(ii) (1) same number of protons
*accept same number of electrons
accept same atomic number*

1

(2) different numbers of neutrons

1

(b) (i) 90

1

(ii) 140

1

(c) alpha (particle)

reason may score even if beta or gamma is chosen

1

mass number goes down by 4 **or**

number of protons and neutrons goes down by 4

or

number of neutrons goes down by 2

*candidates that answer correctly in terms of why gamma **and** beta decay are not possible gain full credit*

1

atomic / proton number goes down by 2 **or**

number of protons goes down by 2

accept an alpha particle consists of 2 neutrons and 2 protons for 1 mark

accept alpha equals ${}^4_2\text{He}$ or ${}^4_2\alpha$ for 1 mark

an alpha particle is a helium nucleus is insufficient for this mark

1

[8]

M3. (a) Y and Z

1

they have the same number of protons **or** same atomic number

*accept they have the same number of electrons **or** same*

number of protons **and** electrons
allow only different in number of neutrons N.B. independent marks

1

(b) **Quality of written communication**

for correct use of terms underlined in B or C

Q ✓ Q ✗

1

A – alpha particle passes straight through the empty space of the atom
or it is a long way from the nucleus

describes 3 tracks correctly for **2** marks

describes 2 or 1 track correctly for **1** mark

B – alpha particle deflected / repelled / repulsed by the (positive) nucleus

C – alpha particle heading straight for the nucleus is deflected / repelled / repulsed backwards

do **not** accept hits the nucleus

do **not** accept answers referring to refraction

do **not** accept answers in terms of reflected backwards

unless qualified in terms of repulsion

mention of difference in charge on nucleus negates that track

max 2

[5]

M4.

(a) 1, 0

X, -1 (X = negligible / very small / (1/1840) to (1/2000), but not nothing

2 for 4 correct

1 for 2/3 correct

2

(b) has a nucleus which is positive charge
negative charges (electrons) orbit nucleus

each for 1 mark

3

[5]

M5.	(a)	90	<i>for one mark</i>	1	
	(b)	(i)	neutron <i>for one mark</i>	1	
		(ii)	nucleus <i>for one mark</i>	1	
		(iii)	electron <i>for one mark</i>	1	
	(c)	(i)	100 <i>for one mark</i>	1	
		(ii)	157 <i>for one mark</i>	1	
					[6]

M6.	(a)	(i)	B <i>for one mark</i>	2	
		(ii)	has a different number of electrons (protons) <i>for one mark</i>		

	(b)	(i)	A and C <i>for one mark</i>	1	[5]
		(ii)	same number of protons / electrons, same nuclear charge different number of neutrons / nuclear masses different <i>for 1 mark each</i>	2	
M7.	(a)	(i)	cannot penetrate aluminium <i>allow can only pass through air / paper too weak is neutral</i>	1	[5]
		(ii)	gamma rays not affected (by aluminium) <i>allow <u>all</u> / <u>most</u> (gamma rays) to pass through</i> <i>too strong is neutral</i> <i>danger is neutral</i>	1	
	(b)	(i)	(nuclei) unstable	1	
		(ii)	causes harm / damage to body / cells <i>allow radiation sickness</i>	1	
			detail e.g., causes mutations / causes cancer / damages DNA / damages chromosomes <i>allow two effects for 2 marks</i>	1	

M8. (a) protons

1

protons

accept electrons

1

neutrons

1

(b) protons

reject mass

1

[4]