Mark scheme

The nuclear atom

Physics 0625 · Questions from Paper 3 and Paper 4

Total marks

66

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
4	6	7	8	5	7	6	6	8	9	**66**

Question 1 [4]

1 **(a)** 5 B1

(b) **(i)** 9 B1

(ii) 4 B1

(c) electrons B1

[Total: 4]

Question 2 [6]

2 **(a)** **(i)** electron B1

(ii) proton <u>and</u> neutron (both, either order) B1

(b) **(i)** (number of) protons accept proton number
NOT no. of protons and electrons B1

(ii) neutron(s) B1

(iii) **1.** 17, accept 2, 8, 7 B1

2. 17, accept 2, 8, 7 B1

[Total: 6]

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Question 3 [7]

3 **(a)** neutron 0 2000 *m* B2
proton +1 2000 *m* B2

(b) 92 B1
146 B1
92 no e.c.f. B1 [7]

Question 4 [8]

4(a)	1st row tick under orbiting the nucleus	**B1**
	2nd row tick under in the nucleus	**B1**
	3rd row tick under in the nucleus	**B1**
4(b)(i)	6	**B1**
4(b)(ii)	13	**B1**
4(c)(i)	same proton / atomic number	**B1**
	different nucleon number / number of neutrons / mass number	**B1**
4(c)(ii)	any acceptable isotope with proton number of 6	**B1**

Question 5 [5]

5 **(a)** **(i)** $x = 88$
AND $y = 38$ B1

(ii) 50 B1

(iii) 38 B1 [3]

(b) different numbers of neutrons / nucleons NOT different no of protons / electrons C1
(strontium-90 has) 52 neutrons / 90 nucleons OR 2 more neutrons / nucleons A1 [2]

Question 6 [7]

6(a)(i)	top: travels to left	**B1**
	middle: deflected down AND still travels to right	**B1**
	bottom: straight on	**B1**

6(a)(ii)	plus OR positive OR +	**B1**
6(b)	79 (electrons)	**B1**
	119 (neutrons)	**B1**
	79 (protons)	**B1**

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Question 7 **[6]**

7	**(a)**	**(i)**	same number of / 92 protons (in nucleus) (IGNORE electrons)	B1	
		(ii)	different number of neutrons	B1	
	(b)		most α-particles travel straight (through the foil)	M1	
			nucleus small / atom mostly empty space	A1	
			small number deflected (through large angles)	M1	
			most of mass in nucleus ACCEPT nucleus positive/charged	A1	[6]

Question 8 **[6]**

8	**(a)**	**(i)**	alpha or α		
		(ii)	beta or β		
		(iii)	gamma or γ	B2	
			Symbols must be clear 3 correct B2 2 correct B1		
	(b)	**(i)**	repulsion	B1	
			α particle and (gold) nucleus / protons of (gold) nucleus have positive charges	B1	
		(ii)	Any two of: Nucleus is very small (compared to size of atom) OR Most of atom is empty space Nucleus is positive / contains protons OR Nucleus has (all) the positive charge of the atom Nucleus is heavy OR Nucleus has most / all of the mass of the atom	B2	**[6]**
			Ignore neutrons		

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Question 9 [8]

9(a)(i)	same number of protons / both have one proton	**B1**
9(a)(ii)	it / hydrogen-3 / $^{3}_{(1)}H$ has one more neutron	**A2**
	different number of neutrons / nucleons	C1

9(b)(i)	(high temperature produces) high (kinetic) energy / momentum / speed / ability to do large quantity of work	**B1**
	they repel each other	**B1**
	are positively charged / have like charges **or** need to come close together	**B1**
9(b)(ii)	$^{4}_{2}X$ **or** $^{4}_{2}He$ **or** $^{4}_{2}\alpha$	**B1**
	$^{1}_{0}n$ **and** no other particle	**B1**

Question 10 [9]

10(a)	(very small) nucleus **and** surrounded by electrons (in orbit / shells)	**B1**
	92 protons **or** 92 electrons **or** number of protons = number of electrons	**B1**
	protons and neutrons in nucleus	**B1**
	143 neutrons	**B1**
10(b)	(uranium-238 has) three more neutrons (in nucleus)	**B1**
10(c)	$^{94}_{(38)}(E)$	**B1**
	$^{(94)}_{38}(E)$	**B1**
10(d)(i)	55	**B1**
10(d)(ii)	140	**B1**

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