	ium-208 is radioactive and emits α -particles with a kinetic energy of $1.07 \times 10^{-12} J$ to nuclei of astatine, as illustrated in Fig. 3.1.	For Examiner's Use
	francium nucleus before decay astatine nucleus	
	α - particle	
	Fig. 3.1	
(a) S	state the nature of an $lpha$ -particle.	
	[1]	
(b) S a _l	show that the initial speed of an α -particle after the decay of a francium nucleus is pproximately $1.8 \times 10^7\text{m}\text{s}^{-1}$.	
	[2]	
(c) (i	State the principle of conservation of linear momentum.	
	[2]	

3

	(ii)	The Francium-208 nucleus is stationary before the decay. Estimate the speed of the astatine nucleus immediately after the decay.	For Examiner's Use
		speed = m s ⁻¹ [3]	
(d)		se examination of the decay of the francium nucleus indicates that the astatine cleus and the α -particle are not ejected exactly in opposite directions.	
	Sug	ggest an explanation for this observation.	
		[2]	

5	(a)	Dist	tinguish between the structure of a metal and of a polymer.	For
		met	tal:	Examiner's Use
		poly	/mer:	
			[4]	
	(b)	Late	ex is a natural form of rubber. It is a polymeric material.	
		(i)	Describe the properties of a sample of latex.	
			[2]	
		(ii)	The process of heating latex with a small amount of sulphur creates cross-links between molecules. Natural latex has very few cross-links between its molecules.	
			Suggest how this process changes the properties of latex.	
			[2]	

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The radioactive decay of nuclei is both spontaneous and random.

Exp	plain what is meant by	
(a)	radioactive decay of a nucleus,	
		. [2]
(b)	spontaneous decay,	
		. [2]
(c)	random decay.	
		. [2]

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8

2 The Brownian motion of smoke particles in air may be observed using the apparatus shown in Fig. 2.1.

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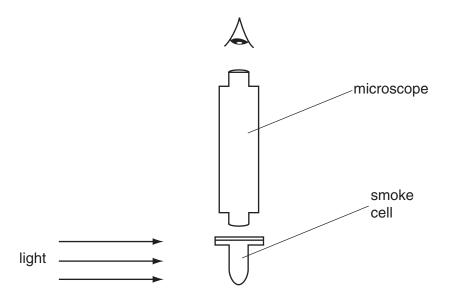


Fig. 2.1

(a)	Describe what is seen when viewing a smoke particle through the microscope.
	[2]
(b)	Suggest and explain what difference, if any, would be observed in the movement of smoke particles when larger smoke particles than those observed in (a) are viewed through the microscope.
	[2]

8 Fig. 8.1 shows the position of Neptunium-231 $\binom{231}{93}$ Np) on a diagram in which nucleon number (mass number) *A* is plotted against proton number (atomic number) *Z*.

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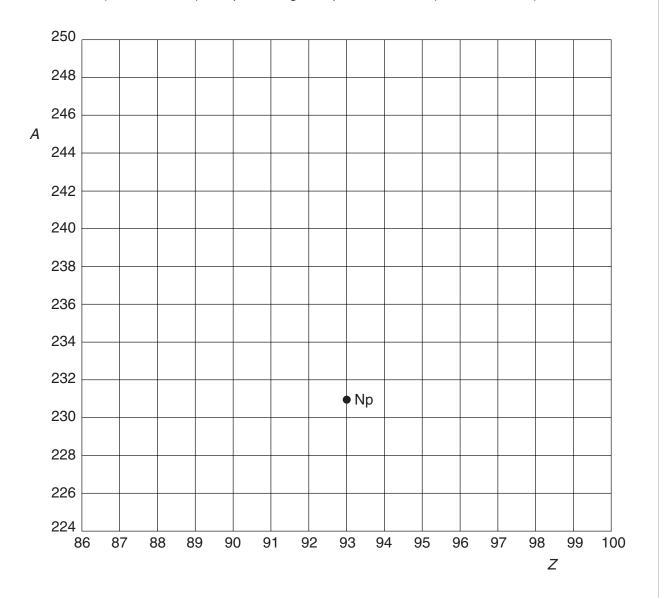


Fig. 8.1

- (a) Neptunium-231 decays by the emission of an α -particle to form protactinium. On Fig. 8.1, mark with the symbol Pa the position of the isotope of protactinium produced in this decay. [1]
- (b) Plutonium-243 ($^{243}_{94}$ Pu) decays by the emission of a β -particle (an electron). On Fig. 8.1, show this decay by labelling the position of Plutonium-243 as Pu and the position of the daughter product as D. [2]

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me α-	darticle scattering experiment provided evidence for the existence of a nuclear atom.
(a) Sta	ate what could be deduced from the fact that
(i)	most $\alpha\text{-particles}$ were deviated through angles of less than 10°,
	[2]
(ii)	a very small proportion of the $\alpha\text{-particles}$ was deviated through angles greater than $90^{\circ}.$
	[0]

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