Question	Answer	Marks	Guidance
1 a	a **fast moving** electron (1)	1	if answer line blank allow correct answer circled or underlined more than one answer = 0 marks
b	mass number is unchanged ✓ nucleus has one more neutron ☐ nucleus has one more proton ✓ atomic number decreases by one ☐	1	both ticks required more than two ticks = 0 marks
c i	$\rightarrow {}^{237}_{93}Np + {}^{4}_{2}He$ (2)	2	any two or three numbers correct = 1 mark

Question	Answer	Marks	Guidance
ii	**any two from** alpha particles cause the air inside the smoke detector to ionise (1) idea that smoke particles absorb / stop (some alpha) radiation (1) less ionisation (of air) **with smoke** [1] current is reduced (causing alarm to sound) (1)	2	**Ignore** references to alpha detector **Ignore** merely particles 'hit' But alpha particles absorbed or stopped by smoke particles so less ionisation of air particles (2)
	Total	**6**	

Question	Answer	Marks	Guidance
2 a	1.9(333) (g/cm^3)	1	
b	2.7 (g) [2] **BUT** if answer is incorrect then 0.9 x 3 scores [1]	2	
c	Mark explanation only B is heaviest [0] Unknown liquid is denser than water [1] Unknown liquid is denser than oil [1] and is liquid X [1]	3	If answer is A then it is still possible to gain up to 2 marks If no clear reference to density of water or oil is made then **allow** unknown liquid is heavier than oil / water [1]
d i	Oil (linear) reduction in density with increasing temperature / ORA [1]	1	
ii	Water density rises up to 5˚ and then falls (non-linearly) as temperature increases AW [1]	1	**Eg.** water's maximum density is at 5^OC [1] **Allow** 3^OC - 6^OC tolerance
d iii	Any two from: Ice (at 0^oC) is less dense (than water at 0^oC) [1]	2	

Question	Answer	Marks	Guidance
	Density of water increases up to $5^{o}C$ [1] (Idea that) water warm**er** as depth **increases** [1]		e.g. 'warmest water at the **bottom**' scores [1]
	Total	**10**	