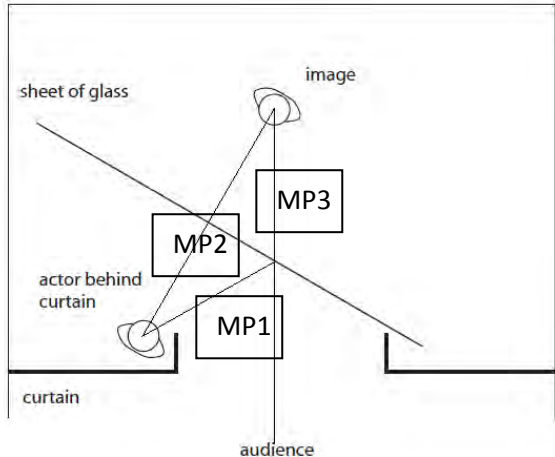
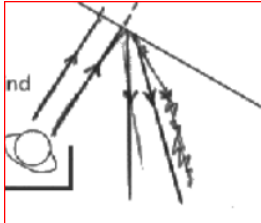


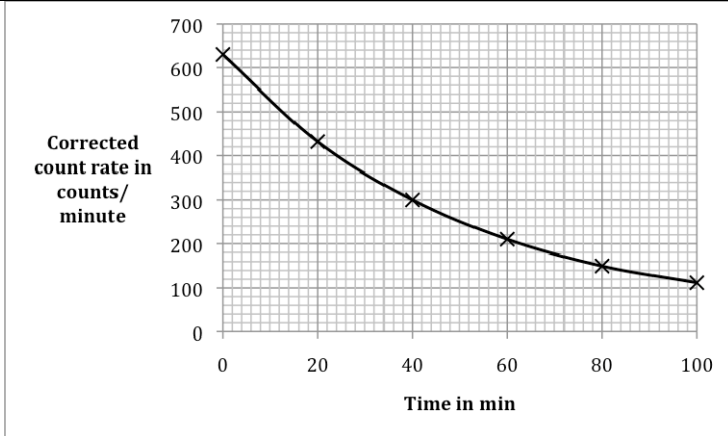
Question number	Answer	Notes	Marks
2 (a)	<p>MP1. Ray <u>reflects</u> correctly (by eye, any ray straight down the page (allow $\pm 10^\circ$), ignore horizontal displacement);</p> <p>MP2. Normal shown / construction line between actor and image;</p> <p>MP3. Reflected ray projecting back to image;</p>	  <p>not spread out from 1 point for MP1</p>	3
2 (b)	<p>any one from:</p> <p>cannot be formed on a screen/eq ;</p> <p>rays do not actually come from there ;</p> <p>rays {diverge/don't actually cross} after reflection;</p> <p>image formed by extension (backwards) of light rays</p>	<p>ignore</p> <p>what is seen in a mirror</p> <p>not real</p> <p>properties of image in mirror, e.g. inverted, same distance</p>	1

Question number			Answer	Notes	Marks
10	(a)	(i)	B radio waves		1
		(ii)	C Microwaves and radio waves travel at the same speed in a vacuum.		1
		(iii)	any one sensible property; e.g. travels (very) fast travel at speed of light can be coded can travel in vacuum	Allow can penetrate the ionosphere, can carry more information (than radio) higher frequency /shorter wavelength (than radio) minimal diffraction	1
	(b)		Quantities substituted in the correct equation; Rearrangement; Calculation; Conversion from hours/days to s at any point (implicit if correct ans in km); e.g. $3.1 = \frac{2 \times \pi \times r}{(24 \times 3600)}$ $r = \frac{3.1 \times 24 \times 3600}{2\pi}$ $r = 42\,600 \text{ km}$	No credit for quoting the equation as $v = \frac{2\pi r}{T}$ is given on page 2. sub and rearrange in either order allow 3600 or 86 400 seen Allow 42630, 42628 Allow 42622 (from $\pi = 3.142$)	4

Question number			Answer	Notes	Marks
11	(a)		Electrical; Chemical / potential;		2
	(b)	(i)	Charge = current x time;	Accept rearrangements and standard symbols e.g. current = $\frac{\text{charge}}{\text{time}}$ $Q = I \times t$ $I = Q/t$ ignore units	1
		(ii)	Substitution; Calculation; Matching correct unit i.e. coulomb/C; e.g. $Q = \frac{400 \times 3.5 \times 3600}{1000}$ 5000 C	Allow mC Allow 5040 MAX 2 if time not converted into s (1.4, 1400, 60, 60 000, seen) POT error seen	3
	(c)		Longer (charging) time needed; Any one of $P = IV$; Lower current OR charge (supplied at a) lower rate; rate of charging lower/ less energy available;		2

Total 8 marks

Question number			Answer	Notes	Marks
12	(a)	(i)	<p>Any two sources:</p> <p>MP1. radiation from rocks/buildings/radon gas;</p> <p>MP2. cosmic radiation / radiation from the Sun / stars;</p> <p>MP3. radiation from medical sources;</p> <p>MP4. nuclear waste / accidents;</p> <p>MP5. some foods e.g. coffee, bananas;</p>	<p>Ignore : cosmic <u>microwave</u> (background) radiation / <u>cmb</u></p> <p>allow named radioactive isotopes</p> <p>accept fire / smoke detector</p>	2
		(ii)	<p>Any three of</p> <p>MP1. Remove the radioactive source;</p> <p>MP2. Measure the (background) count rate;</p> <p>MP3. Repeat the measurement / measure for a long time;</p> <p>MP4. Background radiation is 30 (counts per minute);</p> <p>MP5. Subtract this value from (each) reading(s);</p>	<p>Accept standard abbreviations e.g. cpm</p> <p>Allow for 2 marks: measure the count rate without the source</p>	3

Question number			Answer	Notes	Marks														
12	(a)	(iii)	scale; at least half the paper axes labelled including units; Plotting to nearest sm sq; ; Best fit line to include at least 5 points;	-1 each plotting error, minimum 0 for plotting <table><tr><th>Time in min</th><th>Corrected count rate in counts/minute</th></tr><tr><td>0</td><td>630</td></tr><tr><td>20</td><td>432</td></tr><tr><td>40</td><td>300</td></tr><tr><td>60</td><td>210</td></tr><tr><td>80</td><td>150</td></tr><tr><td>100</td><td>112</td></tr></table>	Time in min	Corrected count rate in counts/minute	0	630	20	432	40	300	60	210	80	150	100	112	5
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20	432																		
40	300																		
60	210																		
80	150																		
100	112																		
																			
		(iv)	Evidence of correct graph use; Correct value;	Allowed range is 35-42	2														

Question number		Answer	Notes	Marks
12	(b)	<p>correct statement about a neutron; e.g. neutron changes neutron number decreases by 1</p> <p>correct statement about a proton/ atomic/number of positive charges in nucleus; e.g. (neutron changes) into a proton proton number increases by 1 number of positive charges increases by 1</p>	<p>ignore : 'it becomes unstable'</p> <p>Accept answers in terms of quarks (down to up) or anti-neutrinos</p> <p>allow for 1 mark if no other mark gained: nucleus becomes another/new element it loses energy nucleus recoils</p> <p>reject: all implication that nucleus becomes ionised</p>	2
	(c)	(i)	<p>MP1. (they emit) ionising radiation; plus any one of -</p> <p>MP2. Cannot be seen; MP3. Can damage/harm cells; MP4. Can cause tumours / cancer;</p>	2
		(ii)	<p>Any three suitable, e.g.</p> <p>MP1. Reduce exposure time; MP2. Handle with tongs/use robotic handling/keep at distance /eq; MP3. Use shielding / work in fume cupboard /eq MP4. Wear film badge / monitor;</p>	3

Total 19 marks

Question number			Answer	Notes	Marks
13	(a)	(i)	substitution / rearrangement; final value for volume; final value for time; e.g. $8 \times 200 = V \times 1$ $V = 1600$ (litres) time = 100 (minutes)	$(p_1V_1 = p_2V_2)$ – no mark as given on page 2. No credit for merely quoting the equation. Allow 99 minutes (i.e. assumption that the final 16 litres not available)	3
		(ii)	Any two suitable points, e.g. MP1. pressure decreases as depth decreases; MP2. reference to $p = h \rho g$; MP3. reference to pV equation (if temperature constant); MP4. additional bubbles join together as they rise; MP5. temperature increases nearer surface;		2
13	(b)	(i)	displacement method described; measure water displaced (with measuring cylinder); OR measure radius / diameter / circumference; calculate volume (with equation);		2
		(ii)	not a fair test; change of temperature / volume;	ignore 'each pump will have different pressure'	2

Total 9 marks