<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td>3 or 4 ticks correct;;
OR
2 ticks correct;

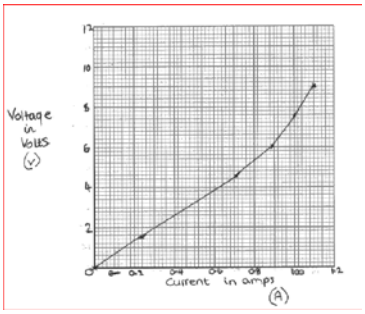
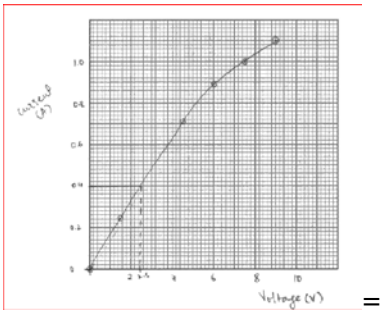
<table><tr><td rowspan="2">Property</td><td colspan="3">Type of radiation</td></tr><tr><td>Alpha particles</td><td>Beta particles</td><td>Gamma rays</td></tr><tr><td>most ionising</td><td>(✓)</td><td></td><td></td></tr><tr><td>largest mass</td><td>✓</td><td></td><td></td></tr><tr><td>most penetrating</td><td></td><td></td><td>✓</td></tr><tr><td>highest speed</td><td></td><td></td><td>✓</td></tr><tr><td>negatively charged</td><td></td><td>✓</td><td></td></tr></table></td><td>ignore top line as this is given</td><td>2</td></tr>
<tr><td>(b) (i)</td><td>Number of neutrons = 2;
Number of protons 2;</td><td>Allow same ideas expressed in words</td><td>2</td></tr>
<tr><td>(ii)</td><td>Any one of-
MP1. Charge is larger (than other radiations);
MP2. Mass is larger (than other radiations);</td><td>comparative statement needed
ignore
• incorrect terminology e.g. more powerful
• references to protons and neutrons
no RA unless particles/radiation specified
condone
‘alpha particles have more momentum’</td><td>1</td></tr>
<tr><td>(c) (i)</td><td>Idea of background radiation;</td><td>Allow
Idea that some alpha particles (from source) will get through smoke
air is all around = insufficient</td><td>1</td></tr>
<tr><td>(ii)</td><td>Idea that radioactivity is random;</td><td>allow
• fluctuates
• source emits different numbers of alphas
• background radiation varies
ignore
• random movement of particles</td><td>1</td></tr>
<tr><td>(iii)</td><td>Idea that α particles are absorbed / deflected /stopped / scattered;

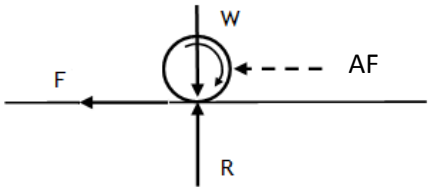
Idea that α particles are affected by <u>smoke</u>;</td><td>allow for both marks
smoke blocks the (alpha) particles</td><td>2</td></tr>
</table>

Total 9 marks

Question number	Answer	Notes	Marks
3 (a)	C (sound waves are longitudinal waves);		1
(b) (i)	C (the same as the amplitude of sound P);		1
(ii)	0.004 (s);	Allow answer by calculation or by reading from graph Allow equivalent value with matching unit, e.g. 4 ms	1
(iii)	500 (Hz)	Treat ii and iii as independent, but allow an ecf from ii to iii if seen Accept "double" P	1

Total 4 marks

Question number	Answer	Notes	Marks
10(a)	any 3 mistakes identified from MP1. cells are connected with wrong polarity; MP2. ammeter is connected in parallel (with wire); MP3. voltmeter is connected in series (with wire); MP4. circuit has not got a switch;	allow RA for any MP allow idea that meters should be swapped for two marks (MP2 and MP3)	3
(b) (i)	suitable scale chosen (> 50% of grid used); axes labelled with quantities and unit; plotting correct to nearest half square (minus one for each plotting error) ;; line of best fit through zero;  = 4 not curve mark  = 5	only scales in 1,2,5,10 or 8 acceptable orientation unimportant points must be shown clearly i.e. two plotting errors = no marks for plotting i.e. smooth curve I: 0.0, 0.2, 0.7, 0.8, 1.0, 1.1 V: 0., 1., 4., 6., 7., 9.	5
(ii)	0.40 A	range 0.39 A to 0.41 A	1
(iii)	One of - MP1. Temperature (of wire) was not constant; MP2. Resistance (of wire) was not constant;		1

Question number	Answer	Notes	Marks
13 (a) (i)	Any two of - MP1. arrow downwards, labelled weight; MP2. arrow upwards, labelled reaction/contact force; MP3. arrow to the left, labelled air friction / air resistance / drag; MP4. arrow along the surface, labelled friction; e.g.  	In MP1, 2 & 3, position of arrows unimportant, but direction must match label Allow initial letters as shown in example ignore • gravity allow • mg • force of gravity • arrow drawn on left or right Accept arrow in either direction for MP4 N = normal contact force	2
(ii)	Any three of - MP1. friction/resistance /drag (acts); MP2. (there is an) unbalanced force; MP3. (hence) ball decelerates; MP4. reference to $f_{(R)} = ma$; MP5. (kinetic) energy dissipates / fate of energy discussed;	ignore stem allow • resistive forces > {forward/driving} force • there is a resultant force • its momentum changes • accelerates	3
(b) (i)	idea that friction is (much) less in the air;	allow • RA • no contact / ground friction • less energy lost	1

Question number	Answer	Notes	Marks
13 (c) (i)	KE = ½ mv^2;	Words or symbols	1
(ii)	Conversion to kg; Substitution into correct equation; Rearrangement; Evaluation; e.g. 45 g = 0.045 kg (or 1 kg = 1000 g etc) $36 = ½ \times 0.045 \times v^2$ $v^2 = \frac{2 \times 36}{0.045}$ (= 1600) 40 (m/s)	allow • 1000 seen • steps in any order • correct answer with no working for full marks • up to 3 marks for use of 45 kg →1.26 (m/s)- working must be seen	4
(iii)	Any one of- • (Hit the ball transferring) more energy; • (Hit the ball with) more velocity; • (Hit the ball with) more speed; • (Hit the ball with) more force;	Ignore • harder • power Allow • momentum • keep contact for a larger part of the swing • go to a place where g is less (e.g. on the moon) • hit ball at a steeper angle / vertically (e.g. use a more lofted club)	1

Total 12 marks

Question number	Answer	Notes	Marks
15 (c) (i)	Any three of - MP1. idea that distance from Earth to Moon varies; MP2. idea that orbit of Moon is not (quite) circular; MP3. idea that change is cyclic / is regular / takes (about) a month; MP4. idea that Earth is not (quite) at centre of (moon) orbit; MP5. appropriate <u>use</u> of time data; MP6. appropriate calculation of a distance;	allow • further/nearer • orbit elliptical • orbit radius varies • sinusoidal • 26.5 / 27 days E.g. largest time difference = 2.70 – 2.47 = 0.23 s e.g. $\Delta s = ½ \times ct$ $= ½ \times 3 \times 10^8 \times 0.23$ = 34 500 km	3
(ii)	Any one of - MP1. (average) moon orbit radius becomes larger; MP2. moon moving away (from Earth); MP3. gravitational force (or gravity) becoming weaker;	Allow reverse argument	1

Total 9 marks